

## **Emigration and Educational Attainment in Mexico**

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Abstract. In this paper we examine the relationship between household migration behavior and educational attainment in Mexico. We ask whether children who live in households with external migrants (e.g., migrants in the U.S.) complete more grades of school at a given age than do other children. In theory, the relationship between emigration and schooling is ambiguous. Sending migrants abroad may generate remittances that raise household income and allow children to complete more schooling, but it may also disrupt family life in a manner that hinders children's scholastic progress. In the estimation, we treat household migration behavior as endogenous, using as instruments the interaction between historical state migration patterns and household characteristics. The preliminary findings are that children in migrant households complete significantly more years of schooling. For girls, the estimated increase ranges from 0.2 years to 0.9 years, but only in households in which parents have low education levels. The results are consistent with emigration helping relax household credit constraints on the financing of education.

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## 1. Introduction

There is a long history of Mexican migration to the United States. Since the early 20<sup>th</sup> century, labor has flowed north from Mexico to escape political instability, to fill jobs in U.S. farms and factories, and to reunite families divided by earlier migrations. There is a natural presumption on the part of academics and policy makers that migration improves the economic livelihood of migrants themselves. Less well understood are the consequences of migration for those who remain behind.

In developing economies, it has become standard to view migration as the outcome of a dynamic contract between members of a household (Lucas and Stark, 1985; Stark, 1991). In Mexico and other poor countries, migration costs are often a large fraction of household income.<sup>1</sup> As a consequence, individuals in a household commonly pool resources to finance migration by one member (or more). Once the migrant is settled in his new locale, he repays the investment by remitting a portion of his income to his family. There is abundant evidence of remittances by migrants in developing countries (e.g., Lucas and Stark, 1985; Durand, 1996; Rozelle et al., 1999). In Mexico, migrant remittances from the United States equaled \$6.6 billion in 2000, or 4% of Mexico's total exports (Woodruff and Zenteno, 2001).

While sending migrants abroad may raise household income, it may also have adverse consequences. Of particular concern for the process of economic development is how emigration affects household investments in human capital. In theory, the effects are ambiguous. The extra income a household gains from remittances may allow

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<sup>1</sup> For illegal migrants from Mexico, who account for about two-thirds of net Mexican immigration in the United States (INS, 2002), the costs of crossing the U.S. border range from \$750 to \$2000 (including fees for fake U.S. documents). On top of these costs would be added those associated with finding a job in a U.S. locale. In 2000, average income for rural Mexican households was \$4470.

children to delay entering the workforce in order to further their studies. However, the departure of wage earners from a household may disrupt family life. It reduces the number of adult role models in the home, may increase the child-rearing responsibilities of resident household members, and may place greater demands on older children to assist in running and supporting the household. These effects may make it more difficult for children to remain in school. Emigration may then increase or decrease household investments in children's schooling, depending on whether the income effects from remittances offset the effects of household disruptions.<sup>2</sup>

In this paper, we examine the impact of migration to the United States on educational attainment in Mexico. We ask whether children who live in households with migrants in the United States have higher levels of educational attainment than children who live in households without migrants. Obviously, having family members in the United States may be influenced by the same factors that influence the schooling of children in the household. To identify the impact of migration on education, we instrument for household migration behavior using data on historical migration patterns in Mexico. These patterns reflect the long-standing importance of migration networks in shaping Mexico-to-U.S. migration (Massey et al., 1994; Munshi, 2002).

Several important issues motivate our analysis. First and foremost, labor flows from Mexico to the United States are large and appear sufficient to have substantial labor-market consequences in both countries. During the 1990s, 3.6 million individuals migrated from Mexico to the United States. By 2000, the U.S. Mexican immigrant population was equal to 7.8% of Mexico's total population. While there is a large

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<sup>2</sup> There are also general equilibrium consequences of emigration that affect human-capital accumulation. Emigration, by changing national labor supplies, may change the returns to skill in a country, thereby altering incentives to invest in education. Such considerations are beyond the scope of this paper.

literature on the labor-market impact of immigration in the United States (see Smith and Edmonston, 1997; and Borjas, 1999a,b, for surveys), there is comparatively little work, beyond descriptive analysis, on how emigration has affected Mexico.<sup>3</sup>

There is some evidence on how remittances affect household behavior in developing countries. Lucas and Stark (1985) examine the determinants of remittances in Botswana. Lucas (1987) finds that in South Africa outmigration from rural areas initially decreases local agricultural production, consistent with a loss in local labor supply, but later increases agricultural productivity as remittances help raise investments in farm operations.<sup>4</sup> Relatedly, Woodruff and Zenteno (2001) find that in Mexico migrant remittances appear to raise household investment in small-scale enterprises. There is little work on the relationship between migration and human capital accumulation.

Our work is also relevant for broader literature on the educational attainment of children. There has been considerable interest in whether growing up separated from one or both birth parents adversely affects a child's schooling and ultimate well-being (e.g., Beller and Chung, 1992; Berhman, 1997; Biblarz and Raftery, 1999). Case et al. (2000), for instance, find that children raised by non-birth mothers obtain less education than other children. There has been little emphasis on whether parental absence due to purely economic considerations has similarly negative effects. This oversight in the literature is not surprising, since most studies focus on high-income economies. In poor countries, the absence of parents from the home due to migration is much more common.

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<sup>3</sup> A large case-study literature examines the impact of migration on sending communities in Mexico (see Durand and Massey, 1992; and Espenshade, 1995 for surveys). This and related bodies of work tend to focus on specific regions in Mexico (e.g., Massey et al., 1994; Durand et al., 1996; Orrenius, 1999; Orrenius and Zavodny, 2001; Hanson, Robertson, and Spilimbergo, 2002) and not on the country as a whole. Exceptions include Cornelius and Marselli (2001), Durand, Massey and Zenteno (2001), Mexico-United States Binational Migration Study (1998), and Chiquiar and Hanson (2002).

<sup>4</sup> See also Taylor (1992) and Rozelle et al. (1999).

The remainder of the paper is as follows. In section 2, we outline an empirical framework for our analysis. In section 3, we present summary statistics on educational attainment of children, household characteristics, and household migration behavior. We focus on years of schooling completed by 10-15 year-old boys and girls. In section 4, we present the empirical results. And in section 5, we conclude.

## **2. Migration Behavior and Accumulated Schooling**

In this section, we develop a simple empirical framework to examine the impact of household migration behavior on the educational attainment of children. We then discuss estimation issues related to implementing our specification.

### **2.1 An Empirical Model**

Viewed as an investment decision, an individual will continue her education up to the point where the returns to extra schooling (higher lifetime income) just equal the costs of extra schooling (foregone earnings plus tuition). To apply this logic to the case of Mexico, we need to recognize that (i) education decisions within the household are not always treated as investment decisions and (ii) in developing countries the perceived cost of foregone earnings may be very high. Previous literature on educational attainment identifies family structure, family income, and parental education as key determinants of schooling outcomes for children. We apply these insights to the case of Mexico and derive an empirical model in which educational attainment for a child will be a function of individual, household, and regional characteristics.

In our data, the variation in educational outcomes is cross-sectional. At a given age, different children have completed different levels of schooling. In theory, these

differences in educational attainment will be due to differences across households in the perceived returns to and costs of additional schooling. The returns to education will vary across children due in part to individual heterogeneity. Children who are perceived as more able will have higher expected returns to education. While we do not observe a child's ability, we do observe a correlate of ability, parental education. Parents who obtained high levels of schooling may be more likely to have children for whom it is also optimal to obtain high levels of schooling. We use the mother's education (since the father may be absent due to emigration) as a proxy for a child's ability.

There are, of course, other reasons why parental education may help predict schooling outcomes for children. For some parents, education may be a consumption good, as well as an investment good. More-educated parents may be individuals who place a high consumption value on education and who are willing to invest more heavily in educating their children. Parents also transmit values to their children regarding important life choices, including education. More-educated parents may be positive role models in the educational choices of their children.

The costs of allowing a child to obtain additional schooling will vary across children due in part to household differences in resource constraints. Informational problems may complicate financing human capital investments through credit markets, forcing households to finance education internally. In poor countries, the main cost of education is generally not tuition, books, uniforms or other direct costs but the foregone earnings of the child. These costs may be especially high in households in agricultural areas. Imperfect credit markets may thus prevent low-income parents from being able to finance desired education levels for their children.

If credit constraints bind, two effects follow: holding family size constant, a child's schooling is likely to be decreasing in family income; and, holding family income constant, a child's schooling is likely to be decreasing in family size (since in bigger families there are more children to educate). We observe family income in our data, but introducing it as an explanatory variable may create simultaneity, as family income may be correlated with unobserved shocks to a child's schooling. Instead, we control for household resource constraints using measures of household earnings potential (age and education of the parents) and household wealth (home ownership).

Additional sources of variation in schooling costs include differences in the productivity of child labor and in the costs of getting to school. In farm households, there may be many productive activities in which children could participate, making it costly to keep children in school full time. We control for local labor market opportunities in agriculture using the prevalence of employment in agriculture in the household's municipality. If children in rural areas wish to continue education beyond primary school they may face long commutes or have to settle for schools with sub-standard infrastructure. We control for the quality of local infrastructure using measures of public services available in the municipality.

Moving beyond a simple investment model of educational choice, there are many ways in which family structure may influence a child's educational attainment. Disruptions to family life due to marital conflicts between parents may affect the resources that households devote to educating children. Children in single-parent households may face greater social or economic hardships of one kind or another. We include a number of controls for family composition in the estimation.

This brings us to the main question of interest, which is how having external migrants influences schooling outcomes for children in a household. It does so, in part, by affecting household income. If earnings for migrants are high relative to non-migrants and if migrants remit earnings to their families, then having a migrant abroad may raise family income, ease credit constraints, and allow children in the household to obtain more schooling. But having migrants abroad also disrupts family life, possibly in a manner that is deleterious for schooling. Emigration removes adult role models from the household and may increase the household responsibilities of older children, either of which may slow children's scholastic progress.

We characterize educational attainment for child  $g$ , in household  $h$ , and region  $i$  by the following reduced-form expression:

$$S_{ghi} = \beta X_{ghi} + \theta Z_{ghi} + \varepsilon_{ghi} \quad (1)$$

where  $S_{ghi}$  is the number of school grades completed;  $X_{ghi}$  is a vector of characteristics describing family resource constraints and potential returns to education for the child, including age of the child, whether the child speaks an indigenous language, whether the child has a disability, the age and education of the mother, household wealth, and local labor-market conditions;  $Z_{ghi}$  is a vector of characteristics describing family structure, including number of children, whether the mother is married, and whether the household head is female; and  $\varepsilon_{ghi}$  is a disturbance whose properties we discuss below.

Let  $M_{ghi}$  indicate whether a household has a member who has migrated to the United States.  $M$  affects  $S$  both through its effects on family income and through its effects on the organization of the household. The total effect of  $M$  on  $s$  is then,

$$\frac{\partial S}{\partial M} = \frac{\partial S}{\partial X} \frac{\partial X}{\partial M} + \frac{\partial S}{\partial Z} \frac{\partial Z}{\partial M}. \quad (2)$$



The first term on the right of (2) is the impact of external migration on a child's educational attainment through its impact on family income. We expect this term to be positive. The second term on the right of (2) is the impact of external migration on a child's education attainment through its impact on family structure. We expect this term to be negative. In theory, the total effect of household migration behavior on schooling for children is ambiguous and is a question to be resolved empirically.

## **2.2 Estimation Issues**

Perhaps the most important estimation issue that we need to address in our empirical work is the potential simultaneity of household migration behavior and schooling outcomes. Unobserved characteristics of households may affect both the educational attainment of children and the migration status of individuals in the household. In this case, OLS estimates of the partial correlation between a child's schooling and whether the household has external migrants may be inconsistent.

To motivate our concerns about simultaneity, consider the relationship between household wealth, migration, and schooling. Both migration and education involve fixed costs. If households face credit constraints, poorer households may be less able to send migrants abroad and less able to make educational investments in children. If we do not observe all facets of household wealth, there would be omitted variables correlated with both household migration behavior and schooling. In this example, migration would tend to be positively correlated with unobserved determinants of schooling, leading to upward bias in the OLS estimate of the partial correlation between external migration and educational attainment. As a second example, consider the impact of labor-market shocks. A father losing his job in some previous period would be an unobserved negative

income shock that may have induced the father to migrate to the United States (in order to find a new job) and children in the household to have devoted less time to school and more time to work, leading to less accumulated schooling. In this case, migration would tend to be negatively correlated with unobserved determinants of schooling, contributing to negative bias in the OLS coefficient estimate. These two examples suggest that it is difficult in principle to sign the expected OLS bias.

To address the simultaneity of household migration behavior, we instrument for whether a household has external migrants using the interaction between historical state migration patterns and household characteristics. State migration patterns are an indicator of the strength of regional migration networks in Mexico. These networks have emerged over the course of the last century, as specific regions in Mexico have developed ties with specific U.S. regions. These ties appear to have lowered migration costs for subsequent generations of migrants from those regions. We use data on state migration rates to the United States in the 1950s from Woodruff and Zenteno (2001). Using long lags helps ensure that we are capturing historical characteristics of states that influence migration behavior and not current state economic conditions.

Access to migration networks helps lower migration costs by giving an individual information about entering the United States (legally or illegally), obtaining a job, finding housing, etc. All else equal, households with better access to migration networks should be more likely to send migrants to the United States. But access to these networks is by no means the only factor that influences the household migration decision. The incentive for an individual to migrate to the United States will also depend on expected earnings profiles in the two countries. Differences in earnings profiles will vary with an

individual's age, education, family status, and other characteristics. For instance, Chiquiar and Hanson (2002) find that for Mexico young adults with moderate schooling are the cohort most over-represented among Mexican immigrants in the United States.

Household migration behavior will then be determined by the interaction between a household's access to migration networks and the characteristics of adults in the household. That migration behavior depends on the interaction between migration networks and household characteristics is crucial for our analysis. In the absence of such an interaction, candidate instruments would be confined to variables that either only varied across states or were already regressors in equation (1).

A related estimation issue is that household structure may also be simultaneously determined with migration behavior. If the father of a family migrates to the United States, he leaves behind a female-headed household, which may affect the schooling outcomes of children in the household. In some specifications, we also treat as endogenous whether a household is headed by a female.

### **3. Data**

The data we use for the analysis come from a 10% subsample of the 2000 Mexico Census of Population and Housing.<sup>5</sup> What is unique about this census is that it provides data on members of a household who reside abroad. For each household, the census reports the age, first date of migration, and other data on all members that migrated abroad within the last five years. The data also report remittances households receive

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<sup>5</sup> The 2000 Mexican subsample is based on a random drawing of households, rather than individuals, such that for each household in the sample the data contain information on all individuals in the household.

from these migrants. The Mexico census is one of the few nationally representative samples of households with detailed data on external migration available anywhere.

### **3.1 Sample Definition**

We focus our analysis on accumulated schooling for 10-15 year olds in rural areas. By accumulated schooling, we mean the number of school grades completed and not simply the number of years spent in school. Accumulated schooling is a widely used measure of investment in human capital. It is more informative than alternatives, such as whether or not a child attends school. Disruptions may slow a child's scholastic progress, without forcing the child to leave school altogether.

The 10-15 year-old cohort is an age group for which educational outcomes vary and for which most children live with their parents. School attendance for this age group is high; for the children in our sample 82.5% report attending school. In Mexico primary school attendance (grades 1-6) has been mandatory for many years.<sup>6</sup> As a result, before age 10 there is relatively little variation in accumulated schooling. After age 15, in Mexico as in many poor countries, many children leave school. More important for our analysis, they also begin to move away from home, either to continue schooling, to work elsewhere in Mexico, or to migrate to the United States, making it impossible for us to link them to their birth family.<sup>7</sup>

We limit the sample to households in rural areas (population of 15,000 inhabitants or less, which in 2000 accounted for 45.6% of 10-15 year olds in Mexico) in order to help

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<sup>6</sup> In 1992, attendance in secondary school (grades 7-9) became mandatory in Mexico. While the fraction of children completing secondary school rose sharply in the 1990s, there is still widespread non-compliance with this regulation. Many parts of the country still lack a secondary school.

<sup>7</sup> For 10-15 year olds in rural areas, the fraction of children whose household head is a parent is 95.0% (and is stable across ages in this group). This fraction falls to 90.7% by the time children are 18 years old.

attenuate problems associated with sample selection. Emigrants from rural areas appear to be more likely to leave their families in Mexico while emigrants from urban areas appear to be more likely to emigrate with their families (Massey et al., 1994; Cornelius and Marselli, 2001; Durand et al., 2001). As a result, in urban areas the census may miss many families with external migrants because the entire family has left the country.

What may explain differences between rural and urban migration patterns is that rural emigrants are more likely to be farm laborers. An individual U.S. farm typically demands manual labor for less than two months during the year. To keep employed, farm workers must move repeatedly during the spring, summer, and fall, making it difficult to have their families with them. The winter lull in U.S. agriculture permits them to return to Mexico to visit their families during the December-January holiday season. Emigrants from urban areas of Mexico, in contrast, tend to settle in a specific U.S. locality and to have jobs that are more permanent in nature. This makes it easier to bring their families with them to the United States and complicates the alternative of making regular visits to Mexico. By limiting the analysis to rural areas, we help reduce the relative proportion of cases where the entire household has emigrated.

We also impose several other sample restrictions. First, we restrict the sample to children who are sons or daughters of the household head (which in 2000 accounted for 95.0% of 10-15 year olds in rural Mexico). This helps ensure that we are observing children for whom the parents (and not someone else) make decisions regarding schooling. Second, we exclude from the sample households headed by a male with no spouse, such that we are left with households that either have a male head and a female spouse or are headed by a female (which in 2000 accounted for 97.1% of 10-15 year olds

in rural Mexico). In the empirical analysis of children's educational attainment, it is standard to use schooling outcomes for parents to project schooling outcomes for the child. We ensure the mother is present to be able to compare the mother's schooling and other characteristics across households. It is not possible to compare fathers across households since in the majority of rural migrant households it is the father who goes abroad. Third, we restrict the sample to households in which the mother (the female head or the female spouse) has 12 or fewer years of education (which in 2000 accounted for 98.0% of 10-15 year olds in rural Mexico). External migrants from households with high parental education levels tend to be students who have gone to the United States for college. Excluding these households from the sample helps ensure that we are comparing households that would consider sending migrants abroad to work (and so to remit income to their families in Mexico) and not solely to further their schooling.

### **3.2 Summary Statistics**

Table 1 reports data on household migration behavior in our sample. The 2000 Mexico population census asks whether anyone who had resided in a household during the previous five years is currently living in the United States (or another country). In 2000, 9.2% of 10-15 year olds in our sample lived in households that had working age (16-65 years old) migrants in the United States.<sup>8</sup> A smaller fraction, 5.7%, lived in households that reported receiving remittances from U.S. migrants. Reported remittances are likely to be a noisy measure of actual remittances. Some migrants send income home by wire transfer, which would presumably get reported to the census as remittances,

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<sup>8</sup> For 99.0% of the households with external migrants in our sample, the United States is the country in which the migrants reside. Anecdotal evidence suggests that the few migrants to other countries are primarily students. For this reason, we restrict our attention to U.S. migrants. We focus on external migrants who are of working age to ensure that they have the capacity to remit labor income.

while others send goods or bring money home personally, which may not be reported as remittances. In our empirical work, we focus more on whether households have external migrants than on whether households report receiving remittances.

Table 2 reports summary statistics on 10-15 year-old boys and girls in migrant and non-migrant households. Children in migrant households are somewhat more likely to be literate, are somewhat less likely to attend school, and have accumulated an average of 0.2-0.3 years more schooling. But children in migrant households are also slightly older, which could account for these differences in schooling behavior. Migrant households on average have slightly fewer total residents, slightly fewer adults, and slightly higher income. Not surprisingly, migrant households receive a lower fraction of their income from labor (as opposed to remittances, rent, government transfers, etc.). Migrant households are more likely to be located in small villages.

Mothers in migrant households on average are older and have fewer years of schooling. They are more likely to be married, more likely to own their own home, more likely to be Catholic (as opposed to Protestant or another religion), and much more likely to be the only parent in the household. The average accumulated schooling of the mother is quite low. There are large differences in educational attainment across generations in Mexico, especially in rural areas, such that children in our sample are likely to nearly double the accumulated schooling of their mothers.<sup>9</sup> Table 3 reports the fraction of children in our sample with mothers who have completed given levels of schooling (recall that we have dropped the 2.0% of rural households in which mothers have more than 12 years of education). For the mothers represented in our sample, 20.6% report no schooling, 16.5% report 1-2 years of schooling, and only 3.0% report 10-12 years of

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<sup>9</sup> Average schooling for 21-24 year olds in rural areas of Mexico in 2000 was 7.0 years.

schooling. In theory, credit constraints should bind most severely for households in which parents have very low education levels and so low earnings potential. This suggests that in households with less-educated mothers having external migrants will have a relatively large impact on children's educational attainment.

There are strong differences in region of residence between migrant and non-migrant households. Children in households with external migrants are more likely to live in the center or north of the country and less likely to live in states along the U.S.-Mexico border, near the capital in Mexico City, in the oil and tourism oriented Yucatan peninsula, or in the far south. There is a common belief that migrants to the United States tend to come from the poorest parts of Mexico (the south) or from the regions that are most proximate to the United States (the border). This is clearly not the case.

To show regional migration patterns in more detail, Table 4 reports current and historical migration rates to the United States by Mexican state. Historical migration rates are from Woodruff and Zenteno (2001), who base their figures on U.S. immigration from Mexico under the Bracero Program in the 1950s. During the Bracero Program (1946-1964), the United States admitted individuals from Mexico to work for a period of one year, usually in agriculture. During the program's height in the late 1950s, over 400,000 Mexican workers were admitted annually. They accounted for the vast majority of U.S. immigration from Mexico during this period. The U.S. government recorded the state of residence in Mexico for entering braceros, making this one of the few data sources available that gives state of origin for entering Mexican immigrants.



It is apparent in Table 4 that migration rates from Mexican states have been quite stable over time.<sup>10</sup> The correlation between state migration rates to the United States for rural households in 2000 and for the Bracero Program over 1955-1959 is 0.76.<sup>11</sup> What this stability may reflect is the existence of long-standing regional migration networks in Mexico, through which successive generations of Mexican workers have gained entry to the United States and found jobs north of the border.

### **3.3 Preliminary Evidence on Emigration and Educational Attainment**

Table 2 suggests that children in migrant households tend to accumulate more schooling, without controlling for observable characteristics. In Table 5, we see whether these differences in accumulated schooling still exist once we introduce a simple set of controls for age of the child and education of the mother. The first set of rows shows that across all households girls in migrant households tend to accumulate 0.11 to 0.21 additional years of schooling and that boys in migrant households tend to accumulate 0.06 to 0.12 years of additional schooling. As a first pass, these results are consistent with the idea that having an external migrant boosts household income and allows children to obtain more education.

The next two sets of rows separate out the bottom third of households in which mothers have low education levels (0-2 years) from the remaining households in which mothers have moderate to high education levels (3-12 years). In households with less-educated mothers, having an external migrant is associated with an extra 0.35 to 0.52

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<sup>10</sup> This is true at least when comparing migration of agricultural workers under the Bracero Program to migration from rural areas of Mexico today. Migration under the Bracero Program may not be as good of an indicator of current regional migration patterns from urban Mexico.

<sup>11</sup> This stability in regional migration patterns appears to have held for most of the 20<sup>th</sup> century. The correlation across Mexican states between migration rates to the United States under the Bracero Program for 1955-59 and those reported in a U.S. Department of Labor Study for 1924 is 0.77.

years of schooling for girls and an extra 0.22 to 0.42 years of schooling for boys. In households with more-educated mothers, in contrast, the gain in accumulated schooling for children in migrant households is much smaller in absolute value and negative in some cases for girls and all cases for boys. These results are consistent with the idea that having an external migrant has the largest impact on children's accumulated schooling where credit constraints are the most binding. Next, we examine whether these results are robust to the inclusion of a larger set of controls and to controlling for the potential simultaneity of migration and educational attainment.

#### **4. Empirical Results**

In this section, we report regression results for equation (1). The samples for the estimation are boys and girls, 10-12 or 13-15 years old. The dependent variable is the number of school grades completed.<sup>12</sup> The independent variables, defined in an appendix, include the child's age, whether the child speaks an indigenous language, and whether the child is the oldest child in the household; indicators for the educational attainment of the mother, age in quartics for the mother, the fraction of children born to the mother who survive, whether the mother is married, whether the mother is a solo household head, whether the mother has migrated since birth, and indicators for the mother's religion; indicators for whether there are four or more children in the household, whether there are children under six in the household, and whether the household head owns the home; the share of households in the municipality whose head works in

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<sup>12</sup> A log specification is impractical since some children have zero schooling. Still, in unreported results we used a log specification (which entailed losing about 2% of the sample due to zeros) and obtained results that are qualitatively very similar to those that we report below.

agriculture, that have running water, and that have in-house sanitation; and, lastly, whether the household has a member who has migrated to the United States.

We estimate regressions by OLS and by instrumental variables, in which we treat as endogenous whether a household has a migrant in the United States and in some cases whether the mother is a solo household head. To account for unobserved state fixed effects, we include a full set of state controls in the estimation. Standard errors are adjusted for heteroskedasticity of unknown form.

#### **4.1 OLS Results**

Table 6 reports OLS results for the four samples of children. In all specifications there is a positive correlation between educational attainment and whether a household has an external migrant. This is consistent with the idea that sending a migrant abroad raises family income and allows children in the family to complete more schooling. These initial coefficient estimates suggest that the magnitude of this effect is small. A household having an external migrant is associated with no more than 0.09 extra years of schooling for girls or 0.10 extra years of schooling for boys.

Before considering the sensitivity of these results to the specification, we examine coefficient estimates on the other regressors, nearly all of which are estimated precisely. As children grow older, they accumulate fewer years of schooling per additional year of age. Among boys, 10-12 year olds accumulate on average 0.8 years of schooling for each additional year of age, while 13-15 year olds accumulate only 0.6 years. This reflects the fact that after primary school many children slow or cease their educational progress. Children who speak an indigenous language accumulate significantly less schooling, with the effect being larger for girls. This is consistent with children in indigenous

communities in Mexico facing greater disadvantages in obtaining public education. Not surprisingly, children with physical disabilities accumulate much less schooling.

Consistent with previous work, family structure appears to have important effects on educational attainment. Oldest children complete more schooling, which may indicate that parents tend to invest more in their first born. Children who live in households with more children or with very young children obtain less education. This is consistent with the idea that resource constraints force parents in larger families to invest less in the schooling of each child in the household. Children born to married mothers complete more schooling, which may indicate that stable family environments promote scholastic progress. Contrary to our expectations, children whose mothers are solo household heads do not complete less schooling. This result is suspicious and adds to concerns about the potential endogeneity of this variable.

Also consistent with previous work, children with more educated mothers accumulate more schooling. Relative to a mother with no schooling, a 13-15 year old with a mother who has 9-12 years of schooling completes an extra 1.5 years of education. This result is consistent with higher income families being able to afford more schooling for their children, with it being optimal for children of higher ability parents to complete more schooling, and with more-educated parents placing a greater value on their children's education. A higher survival rate for children in the household is associated with more schooling, which may indicate that children obtain more schooling in families where children are on average healthier. Alternatively, the survival rate may simply be a proxy for household wealth. Consistent with a wealth effect on education, children in households whose head owns the home complete more schooling.

There is some evidence that regional effects matter for schooling outcomes. Children living in municipalities that are more specialized in agriculture complete less schooling, which may indicate that children attend school less regularly where they have nearby employment options on the farm. Children living in municipalities with wider availability of water and sanitation services obtain more schooling, which may indicate that municipalities that invest more in infrastructure also do more to promote education. Alternatively, the availability of municipal services may simply capture the average wealth of the locality, which is likely to be positively correlated with schooling.

In Table 7, we use an alternative measure of household migration behavior. Instead of an indicator for whether the household has a migrant in the United States, we use an indicator for whether the household receives remittances from the United States. We report coefficient estimates for this variable only, since other coefficient estimates are very similar to those in Table 6. For all four samples, the coefficient on receiving remittances from the United States is positive and precisely estimated. This is again consistent with the idea that sending a migrant abroad raises family income and helps children complete more schooling. The coefficient on receiving remittances in Table 7 is very similar in magnitude and statistical significance to the coefficient on having a U.S. migrant in Table 6. This pattern is repeated throughout the estimation. To simplify the exposition, we limit the reported results to those for having a U.S. migrant.

In Table 5, it appears that living in a household that has a U.S. migrant is associated with more accumulated schooling only for children whose mothers have very low education levels. To see whether this finding is robust to additional controls, Table 8 reports the same regressions as in Table 6 but with interactions added between having a

U.S. migrant and the mother's education. For children whose mothers have 0-2 years of education, living in a household with an external migrant is associated with an extra 0.23 years of schooling for girls and 0.18 to 0.26 years of schooling for boys. But for children whose mothers have 3 or more years of schooling external migration is not associated with any increase in accumulated schooling. Thus, external migration only appears to matter for educational attainment in families with parents that have very low education levels. In such households credit constraints are more likely to bind, making remittances from migrants a potentially important source of educational finance.

#### **4.2 Instrumental Variable Results**

The IV regressions we report control for the endogeneity of household migration behavior and in some cases for the endogeneity of whether the household has a solo female head. The instruments are rates of migration to the United States for Mexican states over the period 1955-1959 interacted with the age, education, and other characteristics of the mother.<sup>13</sup> Since we include state dummy variables in the estimation, we cannot include state migration rates themselves as instruments. Identification comes from the correlation between household migration behavior and the interaction terms for historical state migration rates and household characteristics.

The logic behind these instruments is that historical migration rates capture the existence of regional migration networks and the characteristics of the mother – which proxy for the characteristics of the adults in the household – capture the incentive for individuals in the household to migrate. Individual characteristics will matter for the

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<sup>13</sup> The terms interacted with state migration rates include age in quartics for the mother, dummy variables for the mother's educational attainment, whether the mother speaks an indigenous language, and whether the mother has migrated since birth. In some specifications we also include municipal infrastructure measures in the set of interaction terms.

incentive to migrate as long as the returns to emigration vary across individuals according to age, skill, and other attributes. There is evidence in the literature that this is the case. Hanson and Chiquiar (2002) find that wage gains to migrating from Mexico to the United States are largest for younger individuals with lower education levels (though migration costs may be relatively large for these individuals as well). We expect migration to be more likely where regional migration networks are stronger (i.e., where historical state migration rates are high) and adults in the household have characteristics that are consistent with larger gains to migrating to the United States.<sup>14</sup>

Table 9 reports results in which we instrument for whether the household has a U.S. migrant and the interaction between this variable and the mother's schooling. Consider first the results for girls. The coefficient estimate on having a U.S. migrant is positive, very precisely estimated and much larger than the corresponding coefficient in Table 8. The interaction between this variable and whether the mother has 3-12 years of schooling is again negative and precisely estimated and of roughly the same absolute value as the coefficient on having a U.S. migrant. Migration to the United States is associated with an extra 0.9 years of education for 10-12 year old girls and an extra 0.7 years for 13-15 year-old girls, but only for girls whose mothers have less than 3 years of education. Similar to the results in the last section, it appears that external migration is associated with more accumulated schooling only in households where the earnings potential of the mother is low. Table 9 also reports the p value on a chi-square test statistic for overidentifying restrictions. We fail to reject these restrictions in the regressions for either sample of girls.

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<sup>14</sup> In all first-stage regressions, the instruments are individually and jointly statistically significant.

The results for the boys are less conclusive and less qualitatively similar to the OLS results. For 10-12 year old boys, the coefficient on having a U.S. migrant is positive and statistically significant (while the interaction between this variable and the mother having 3-12 years of education is small and imprecisely estimated), but we reject the overidentifying restrictions for this regression . For 13-15, we do not estimate precisely the coefficient estimate on having a U.S. migrant.

Finally, in Table 10 we also treat as endogenous whether the mother is a solo household head. These results are similar to those in Table 9.

### **4.3 Other Results**

In unreported results, we have examined whether our results are robust to alternative specifications and sample restrictions. First, we estimated the specification in logs rather than in levels (which resulted in losing 2% of observations with zero schooling levels). These results are qualitatively very similar to those we report here. Second, we excluded households in villages from the sample (population between 2,500 and 15,000 inhabitants) and children whose mothers had 10-12 years of education. These results are also very similar to those reported in Tables 6-10. Third, we added to the instrument set interactions between state migration rates from the 1920s and household characteristics. Given the high correlation between state migration rates in the 1950s and those in the 1920s, these instruments added little new information to the estimation. Fourth, we included additional or alternative measures of family structure, regional industrial specialization, and regional infrastructure. This did not change the results. In



selecting the final specification, we opted for the most parsimonious characterization of family composition and regional environment.

## **5. Conclusion**

In this paper we examine the relationship between household migration behavior and educational attainment in Mexico. We ask whether children who live in households with migrants in the United States complete more grades of school at a given age than do other children. In theory, the relationship between emigration and schooling is ambiguous. Sending migrants abroad may raise household income, allowing children to complete more schooling, but may also disrupt family life in a manner that hinders children's scholastic progress. In the estimation, we treat household migration behavior as endogenous, using as instruments the interaction between historical state migration patterns and household characteristics.

The main findings are that children in migrant households complete significantly more years of schooling. For 10-15 year old girls, OLS estimation results indicate that having a U.S. migrant is associated with an extra 0.23 years of schooling, but only in households in which the mother has less than 3 years of education. IV raises this estimate to be an extra 0.73 to 0.89 years of schooling, again applying only to girls whose mothers have low education levels. Results for boys are smaller in OLS and inconclusive in IV. These findings are consistent with the idea that in low-income households sending a migrant abroad may generate remittances that help relax household credit constraints and raise the educational attainment of children.

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### Appendix: Variable Definitions

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	U.S. Migrant	=1 if member of household 16-65 migrated to U.S. in last 5 yrs.
	Receives Remittances	=1 if household receives remittances from U.S.
Child	Indigenous	=1 if child speaks an indigenous language.
	Disabled	=1 if child has a physical disability.
	Oldest	=1 if child is oldest son or daughter in household.
Household	4-5 Children	=1 if 4 or 5 children of household head live in household.
	6+ Children	=1 if 6 or more children of household head live in household.
	Children under 6	=1 if children of household head under 6 live in household.
Mother	Married	=1 if mother is married.
	Solo Head	=1 if mother is solo household head.
	Own Home	=1 if household head owns home.
	Surviving Children	Fraction of children born to mother that survive.
	Migrated since Birth	=1 if mother does not live in state in which she was born.
	Not Catholic	=1 if mother is religion other than Catholic.
	No Religion	=1 if mother has no religion.
Region	Rural Village	=1 if household located in rural village.
	Agriculture	Fraction of household heads in municipality working in agricult.
	Water Services	Fraction of households in municipality with running water.
	Sanitation	Fraction of households in municipality with sanitation.

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**Table 1: Household Migration Behavior in Rural Mexico, 2000**

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All Households:		Households with U.S. Migrants:
Has Working Age Migrants in U.S.	Receives Remittances from Migrants in U.S.	Receives Remittances
0.092	0.057	0.382

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This table reports the fraction of 10-15 year-old children in rural Mexico who live in households that report having migrants in the United States or receiving remittances from migrants in the United States.

**Table 2: Summary Statistics for 10-15 Year Olds in Rural Mexico, 2000**

		Girls		Boys	
Household has migrants in U.S.?		No	Yes	No	Yes
Child	Age	12.41	12.60	12.42	12.58
	Literate	0.963	0.981	0.958	0.972
	Attends School	0.817	0.786	0.841	0.810
	Years Schooling	5.243	5.529	5.115	5.315
	Works	0.049	0.053	0.125	0.152
	Indigenous Lang.	0.132	0.034	0.133	0.035
	Has Disability	0.008	0.008	0.009	0.009
	Changed States	Since Birth	0.058	0.046	0.058
Last 5 years		0.019	0.015	0.019	0.014
Household	No. of Persons	6.763	6.644	6.695	6.640
	No. of Adults	2.617	2.559	2.605	2.556
	Annual Income (\$)	4,473	4,535	4,456	4,514
	Income from Labor	0.732	0.497	0.733	0.508
	Population < 2,500	0.666	0.724	0.669	0.727
Mother	Age	38.64	41.56	38.60	41.55
	Years Schooling	3.885	3.598	3.873	3.561
	Married	0.783	0.859	0.780	0.862
	Only Parent in House	0.097	0.309	0.096	0.311
	Catholic	0.864	0.927	0.861	0.925
	Owns Home	0.881	0.914	0.880	0.919
	Surviving Children (share)	0.936	0.934	0.936	0.935
	Changed States since Birth	0.107	0.093	0.108	0.090
Region	Border	0.076	0.040	0.077	0.041
	North	0.129	0.208	0.129	0.210
	Center	0.429	0.591	0.428	0.591
	Capital	0.098	0.043	0.097	0.042
	Yucatan	0.074	0.007	0.074	0.007
	South	0.194	0.111	0.195	0.109
N		297,315	30,844	308,790	31,444

This table shows sample means for children 10-15 years old living in rural areas, broken down by gender and by whether the household has migrants living in the United States.

**Table 3: Educational Attainment of Mothers in Rural Mexican Households, 2000**

Years of Schooling for Mother	Household has U.S. migrants?		Total
	No	Yes	
0	20.82	18.2	20.58
1	5.55	6.21	5.61
2	10.64	13.08	10.86
3	13.99	17.78	14.34
4	7.68	8.8	7.78
5	4.8	5.4	4.86
6	23.03	21.88	22.92
7	0.93	0.84	0.93
8	1.47	1.26	1.45
9	7.98	5.04	7.71
10	0.34	0.22	0.33
11	0.62	0.29	0.59
12	2.16	1.01	2.05

This table shows the percent distribution of households in rural Mexico with 10-15 year-old children that have mothers with given education levels (years completed schooling).



**Table 4: Current and Historical Migration Rates by Mexican State (%)**

Region	State	Households w/ Migrants in U.S., 2000	Households Receiving U.S. Remitt., 2000	Population Migrating to U.S., 1955-59	Per Capita GDP (\$), 1995
Border	Baja California	2.9	2.7	0.8	1,912
	Chihuahua	7.2	4.4	3.4	2,062
	Coahuila	4.2	3.0	2.8	2,058
	Nuevo Leon	4.8	3.2	2.7	2,586
	Sonora	2.4	2.4	0.5	1,803
	Tamaulipas	7.1	3.3	0.9	1,623
North	Aguascalientes	23.1	13.8	3.2	1,728
	Baja California Sur	1.9	1.2	0.8	1,947
	Durango	16.9	13.0	5.5	1,329
	Nayarit	11.3	7.6	0.8	914
	San Luis Potosi	12.6	9.9	2.5	1,094
	Sinaloa	6.6	4.8	0.5	1,195
	Center	Colima	11.1	7.9	1.3
Guanajuato		23.6	14.1	4.1	1,062
Hidalgo		11.1	5.3	0.3	966
Jalisco		18.9	12.3	2.0	1,479
Michoacan		19.3	11.3	3.1	901
Morelos		10.9	5.6	0.8	1,263
Puebla		7.0	3.8	0.3	1,006
Queretaro		12.7	6.6	1.4	1,817
Tlaxcala		3.8	2.2	0.5	823
Veracruz		4.7	2.9	0.0	912
Zacatecas		23.0	14.4	5.9	878
Capital	Federal District	1.0	0.6	0.1	3,823
	Mexico	4.3	2.1	0.6	1,205
Yucatan	Campeche	1.6	0.8	0.0	2,341
	Quintana Roo	0.7	0.3	0.0	2,437
	Tabasco	0.7	0.4	0.2	951
	Yucatan	1.4	0.8	0.2	1,159
South	Chiapas	1.0	0.6	0.0	678
	Guerrero	10.3	8.0	1.3	796
	Oaxaca	6.6	4.0	0.8	653

Columns 1 and 2 show migration rates in our sample of rural Mexican households. Column 3 shows migration rates under the Bracero Program. Column 4 is from INEGI.

**Table 5: Average Accumulated Schooling by Household Migration Status**

Household has U.S. migrants?	Girls			Boys		
	No	Yes	Diff.	No	Yes	Diff.
Age						
(a) Full sample						
10	3.343	3.459	0.116	3.201	3.269	0.068
11	4.192	4.387	0.195	4.058	4.118	0.060
12	5.038	5.248	0.210	4.874	4.984	0.110
13	5.820	5.979	0.159	5.686	5.805	0.119
14	6.413	6.519	0.106	6.304	6.390	0.086
15	7.034	7.145	0.111	6.917	6.943	0.026
(b) Mother has 0-2 years of schooling						
10	2.893	3.239	0.346	2.764	2.986	0.222
11	3.692	4.118	0.426	3.574	3.860	0.286
12	4.500	4.978	0.478	4.327	4.753	0.426
13	5.217	5.583	0.366	5.101	5.520	0.419
14	5.673	6.114	0.441	5.631	5.981	0.350
15	6.115	6.633	0.518	6.125	6.506	0.381
(c) Mother has 3-12 years of schooling						
10	3.572	3.571	-0.001	3.425	3.407	-0.018
11	4.453	4.527	0.074	4.307	4.258	-0.049
12	5.346	5.401	0.055	5.197	5.126	-0.071
13	6.188	6.212	0.024	6.042	5.988	-0.054
14	6.896	6.796	-0.100	6.751	6.665	-0.086
15	7.650	7.484	-0.166	7.458	7.244	-0.214

This table shows average accumulated schooling by age, gender, whether the child lives in a household that has migrants in the United States, and the education of the mother.

**Table 6: OLS Results for Accumulated Schooling**

Variable		Girls		Boys	
		10 to 12	13 to 15	10 to 12	13 to 15
U.S. Migrant		0.091** (0.015)	0.083** (0.021)	0.044** (0.016)	0.095** (0.022)
Child	Age	0.843** (0.006)	0.563** (0.009)	0.831** (0.006)	0.573** (0.009)
	Indigenous	-0.270** (0.016)	-0.522** (0.025)	-0.130** (0.016)	-0.274** (0.024)
	Disabled	-1.907** (0.089)	-2.664** (0.121)	-1.806** (0.079)	-2.860** (0.110)
	Oldest	0.143** (0.011)	0.146** (0.015)	0.177** (0.011)	0.203** (0.015)
Household	4-5 Children	-0.089** (0.012)	-0.184** (0.018)	-0.127** (0.012)	-0.193** (0.018)
	6+ Children	-0.301** (0.015)	-0.585** (0.021)	-0.370** (0.016)	-0.597** (0.021)
	Children under 6	-0.113** (0.010)	-0.180** (0.016)	-0.092** (0.011)	-0.152** (0.016)
Mother's Schooling	1 Year	0.307** (0.024)	0.411** (0.035)	0.243** (0.026)	0.386** (0.034)
	2 Years	0.479** (0.019)	0.638** (0.027)	0.433** (0.020)	0.597** (0.026)
	3-5 Years	0.597** (0.016)	0.816** (0.022)	0.563** (0.017)	0.773** (0.021)
	6-8 Years	0.801** (0.016)	1.259** (0.023)	0.792** (0.018)	1.189** (0.022)
	9-12 Years	0.933** (0.019)	1.558** (0.029)	0.962** (0.020)	1.498** (0.027)
Mother's Characteristics	Married	0.186** (0.013)	0.296** (0.020)	0.223** (0.013)	0.372** (0.019)
	Solo Head	0.005 (0.016)	0.056* (0.026)	0.002 (0.017)	0.082** (0.023)
	Own Home	0.228** (0.016)	0.334** (0.024)	0.238** (0.016)	0.391** (0.024)
	Surviving Children	0.706** (0.042)	1.133** (0.063)	0.740** (0.045)	1.248** (0.060)
Migrated Since Birth		0.018 (0.016)	-0.024 (0.024)	-0.044** (0.017)	-0.027 (0.022)

Municipality/ Region	Not Catholic	-0.023 (0.016)	-0.145** (0.024)	-0.001 (0.016)	-0.030 (0.024)
	No Religion	-0.145** (0.028)	-0.219** (0.040)	-0.118** (0.028)	-0.153** (0.041)
	Rural Village	-0.067** (0.014)	-0.031 (0.021)	-0.040** (0.015)	-0.011 (0.021)
	Agriculture	0.007 (0.026)	-0.252** (0.040)	-0.082** (0.028)	-0.348** (0.038)
	Water Services	0.022 (0.022)	0.012 (0.033)	0.049* (0.022)	0.059 (0.031)
	Sanitation	0.160** (0.024)	0.275** (0.036)	0.069** (0.025)	0.105** (0.035)
	R Squared	0.344	0.257	0.324	0.235
	N	166,428	154,215	172,195	160,299

This table shows coefficient estimates for regressions with number of school grades completed as the dependent variable. The samples are 10-12 and 13-15 year-old girls and boys who are daughters or sons of the household head, who live in rural areas, who live in a household with a female household head or female spouse, and whose mothers have 12 or fewer years of education. Heteroskedasticity-consistent standard errors are in parentheses. All regressions include quartics in the mother's age, dummy variables for the state of residence, and a constant term, which are not reported. See the appendix for definitions of the regression variables. \*\* indicates statistical significance at the 1% level and \* indicates statistical significance at the 5% level

**Table 7: Accumulated Schooling and Remittances from Emigrants**

	Girls		Boys	
	10 to 12	13 to 15	10 to 12	13 to 15
Receives Remittances	0.062** (0.019)	0.088** (0.026)	0.038 (0.021)	0.075** (0.027)
R squared	0.344	0.257	0.324	0.235

This table re-estimates the regressions in Table 6, replacing the variable U.S. Migrant with the variable Receives Remittances (which equals one if the household receives remittances from the United States). See the appendix and Table 6 for more details.

**Table 8: Accumulated Schooling, External Migration, and Mother's Education**

	Girls		Boys	
	10 to 12	13 to 15	10 to 12	13 to 15
U.S. Migrant	0.232** (0.028)	0.229** (0.036)	0.177** (0.029)	0.264** (0.036)
U.S. Migrant* Mother 3-5 Years Ed.	-0.217** (0.037)	-0.236** (0.048)	-0.206** (0.039)	-0.251** (0.052)
U.S. Migrant* Mother 3-8 Years Ed.	-0.222** (0.036)	-0.237** (0.050)	-0.186** (0.040)	-0.296** (0.052)
U.S. Migrant* Mother 9-12 Years Ed.	-0.196** (0.052)	-0.275** (0.086)	-0.268** (0.051)	-0.390** (0.076)
R Squared	0.345	0.258	0.324	0.236

This table re-estimates the regressions in Table 6, adding interactions between the indicator variable U.S. Migrant and indicators for the mother's education. See the appendix and Table 6 for more details.

**Table 9: IV Results for Accumulated Schooling**

Variable	Girls		Boys	
	10 to 12	13 to 15	10 to 12	13 to 15
U.S. Migrant	0.891** (0.260)	0.731* (0.350)	0.827** (0.242)	0.053 (0.765)
U.S. Migrant*Mother 3-12 Years Ed.	-0.602** (0.188)	-0.846** (0.235)	0.075 (0.232)	-0.401** (0.141)
Mother Solo Head	-0.071 (0.060)	0.052 (0.067)	-0.186** (0.060)	0.141 (0.157)
Chi-Square p value	0.412	0.453	0.000	0.688
N	166,428	154,215	172,195	160,299

This table reports instrumental variable results for the specifications shown in Table 6. The interaction between U.S. Migrant and an indicator for whether the mother has 3 to 12 years of schooling has been added to the set of regressors. All other regressors are the same (coefficient estimates for which are not shown). The variables U.S. Migrant and its interaction with Mother 3-12 Years of Ed. are treated as endogenous variables. The instruments are interactions between historical state migration rates and characteristics of the mother (see text). The Chi-Square p value is the p value for the chi-square test statistic on the overidentifying restrictions.

**Table 10: Additional IV Results for Accumulated Schooling**

Variable	Girls		Boys	
	10 to 12	13 to 15	10 to 12	13 to 15
U.S. Migrant	1.210*	0.928*	0.598*	2.262
	(0.494)	(0.402)	(0.278)	(5.308)
U.S. Migrant*Mother 3-12 Years Ed.	-0.601**	-0.897**	0.122	-3.649
	(0.194)	(0.239)	(0.244)	(8.095)
Mother Solo Head	0.550	0.752	-0.863*	3.206
	(0.879)	(0.608)	(0.415)	(7.209)
Chi Square P value	0.390	0.759	0.000	0.646
N	166,428	154,215	172,195	160,299

This table reports instrumental variable results for the specifications shown in Table 6. The interaction between U.S. Migrant and an indicator for whether the mother has 3 to 12 years of schooling has been added to the set of regressors. All other regressors are the same (coefficient estimates for which are not shown). The variables U.S. Migrant, the interaction between U.S. Migrant and Mother 3-12 Years of Ed., and Mother Solo Head are treated as endogenous variables. The instruments are interactions between historical state migration rates and characteristics of the mother (see text). The Chi-Square p value is the p value for the chi-square test statistic on the overidentifying restrictions.