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BEYOND REMITTANCES: THE EFFECTS OF MIGRATION ON MEXICAN HOUSEHOLDS

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Introduction

The number of international migrants in the world increased by 21 million between 1990 and 2000, a 14 percent increase, resulting in 175 million people living in a country outside their birth (United Nations 2002). Remittances from migrants have grown rapidly over the same time, with developing countries receiving $126 billion in 2004 (Ratha 2005). The United States holds the largest stock of immigrants and is the source of the largest share of remittances. Mexicans are by far the largest immigrant group in the United States, and are estimated to amount to approximately 15 percent of Mexico's working age population (Mishra 2003).

The scale and growth in remittances has attracted increased intention regarding the development impact of these flows (for example, Ratha 2005; International Monetary Fund 2005). However, identifying the effects of remittances on households is difficult, because both the decision to migrate, and the decision among migrants of how much to remit, are likely to be related to the outcomes of interest. The chapter estimates the overall impact of Mexican migration to the United States on several household outcomes, and shows that migration has a number of impacts that are distinct from the direct effects of remittances. I draw on the findings of recent research I have conducted with Nicole Hildebrandt and Hillel Rapoport on the impact of migration on child health (Hildebrandt and McKenzie forthcoming), the probability of other community members migrating and on inequality in the sending community (McKenzie and Rapoport 2004), and education (McKenzie and Rapoport 2005).

Migration is shown to improve child health outcomes, lowering infant mortality and increasing birthweights. While some of the improvement in health outcomes is likely to arise from the increase in household income after remittances, it is shown that migration has at least two additional impacts on child health. Higher opportunity costs of time and the absence of parents may make children of migrants less likely to receive some forms of health inputs. Evidence for this effect is seen in children in migrant households having a lower probability of being breastfed and of receiving their full dose of vaccines. A more positive impact is seen in terms of maternal health knowledge. Mothers in migrant families are found to have higher levels of health knowledge, and there is also evidence of knowledge spillovers to mothers in nonmigrant households.

A second role for migration, other than through the direct effect of remittances, is in the creation of networks of individuals with migration experience. Sociologists have long emphasized the role of social networks in the migration process. Friends and relatives with previous migration experience may help new immigrants in the process of crossing the border (91 percent of first-time migrants in our sample had no legal documentation), help provide shelter and assistance upon arrival, and arrange jobs for other community members. This chapter shows econometrically that a larger migration network does increase the probability of additional community members also migrating, with differential impacts across the wealth distribution. When few community members have previously migrated, the cost of migration is still relatively high, and it is the upper-middle range of the wealth distribution that benefits most from the migrant network. As more of the community migrates, however, a larger network progressively benefits poorer individuals in the community, because costs fall enough for them to overcome liquidity constraints on migration. As a consequence, the size of the migrant network affects the way remittances and migration change inequality in the sending community. There is some evidence for an inverse-U-shaped relationship between inequality and migration, with the migration of the first few community members possibly raising inequality, and then inequality falling as the migration network grows.

The third role for migration studied in this chapter is its impact on education attainment in Mexico. Education is often seen as one of the areas in which remittances can play a positive role, allowing households to pay for school fees and alleviate liquidity constraints, which prevent parents from attaining the desired level of schooling for their children. However, migration may have other, less positive, impacts on schooling. This chapter provides some preliminary evidence that children age 16 to 18 in migrant households have lower levels of schooling than children in nonmigrant households. This effect is larger for children with more educated parents, who would be expected to have the highest levels of schooling in the absence of migration. The return to education is much higher in Mexico than for Mexican immigrants in the United States, and thus children who anticipate migrating have less incentive to invest in education. In addition, if parents are absent from the household as a result of migration, their children may receive less parental inputs into education acquisition.

Taken together, these results provide strong evidence for a number of impacts of migration on households that are not the direct result of remittances. Studies that focus purely on the effects of remittances are likely to conflate remittance effects with other consequences of migration. In the conclusion, I suggest directions for future research that may help to address these issues.

The remainder of this chapter is structured as follows. The first section discusses the methodology used to identify the impact of migration; the second section describes the data used for analysis. The body of the chapter appears in the third through sixth sections, which estimate the impact of migration on child health, the ability of others to migrate, community inequality, and incentives for education. The seventh section concludes the chapter and provides suggestions for further research. Annex 4.A provides additional technical details on the econometric methods used for estimation.

Can We Identify the Impact of Migration or Remittances?

Remittances are perhaps the most tangible consequence of migration for many households. Coupled with the rapid growth in remittances over the past decade, it is no surprise that a large research interest has focused on the effects of remittances on receiving households. Two main approaches have been employed in the literature. The most basic descriptive approach asks households to identify what remittances are spent on or for what purpose they are intended.[1] However, resources are fungible, and even if the remittance itself is used for one purpose, it may free up other sources of income that may be used for other means.

Therefore, the second approach used is to examine an outcome of interest, such as poverty, education, business ownership, or child health, by comparing households who receive remittances with households that do not. One branch of literature[2] assumes that all the systematic differences between remittance-receiving and non-remittance-receiving households can be explained by a set of characteristics of the migrant, receiving household, and community, X_i, and then estimates the impact of remittances on an outcome of interest through ordinary least squares (OLS) regression of the following equation.

$$\text{Outcome}_i = \mu + \gamma^{*}\text{Remittances}_i + \lambda' X_i + \varepsilon_i \qquad (4.1)$$

However, if migration has other impacts on the outcome of interest in addition to its effect through remittances, then the error term in equation 4.1 contains omitted variables (these other effects of migration) that are correlated with remittances and the outcome variable. As a result, estimates of the effect of remittances will suffer from omitted variables bias. Therefore, we instead focus our attention on the overall impact of having a migrant member, given by the following.

$$\text{Outcome}_i = \alpha + \beta^{*}\text{Migrant}_i + \delta' X_i + \varepsilon_i \qquad (4.2)$$

where Migrant_i is a dummy variable taking the value 1 if a household has a migrant member, and 0 otherwise. The coefficient β then captures the joint impact of remittances and of other consequences of migration. One can then determine whether the sign of the coefficient differs from what would be expected from the impact of remittances alone. Because the decision to migrate may depend on unobserved characteristics of the household that also influence household outcomes, I employ the method of instrumental variables in the estimation, using historic migration networks as an instrument for current migration. This will enable us to determine the overall impact of migration on those left behind, and allow me to show that migration has some effects that are unlikely to be caused by remittances. Annex 4.A provides the technical justification for this methodology and a discussion of why such an instrument is unable to detect the causal impact of remittances as distinct from the overall impact of migration.

Data

The estimates in this chapter are based on data from the 1997 *Encuesta Nacional de Dinámica Demográfica* (ENADID) (National Survey of Demographic Dynamics) conducted by Mexico's national statistical agency, Instituto Nacional de Estadística, Geografía e Informática (INEGI) in the last quarter of 1997. The ENADID is a nationally representative demographic survey of more than 70,000 households. As detailed above, the identification strategy uses historic migration networks to help predict current migration. These historic networks are more important in rural areas, and I therefore restrict our analysis to households in municipalities with populations of less than 100,000.[3] All women ages 15 to 54 in each household are asked detailed questions about their fertility history. This gives a sample of 42,527 women ages 15 to 54 living in 29,498 households located in 612 municipalities across all 32 states that we can use to examine the impact of migration on child health. I restrict the sample to the 214 municipalities in which 50 or more households were sampled in the later sections of this chapter to measure the migration network at the community level and thereby examine its impact on inequality and on the migration of other community members.

The ENADID survey asks whether any household member has ever been to the United States in search of work. This is asked about all household members who normally live in the household, including those who are temporarily studying or working elsewhere. Households are also asked if any household members have gone to live in another country in the past five years. These questions enable us to determine whether a household has a member who has ever gone to the United States, in which case we classify them as a migrant household.[4] We also can then construct the proportion of adults age 15 and over in a community who have ever migrated, which Massey, Goldring, and Durand (1994) call the "migration prevalence ratio."

The Impact of Migration on Child Health

Child health outcomes are an important direct component of household well-being, and a key determinant of future levels of human capital. The Grossman (1972) health production function relates the health status of a given child to the medical and nutritional inputs the child receives (including prenatal and postnatal care and maternal nutrition), the disease environment, the time inputs of the parents, parental health knowledge, biological endowments, and random health shocks. Using this framework, remittances are predicted to improve child health outcomes by allowing the purchase of additional medical and nutritional inputs. Migration may potentially have additional effects on child health through changing the time inputs parents are able to provide, and perhaps through changing the health knowledge of parents as they become exposed to U.S. health practices.[5]

Hildebrandt and McKenzie (forthcoming) examine the impact of migration on child health outcomes by estimating the following version of equation 4.2 for a given child health outcome for child *i* in community *c*.

$$\text{Child health outcome}_{i,c} = \alpha + \beta^{*}\text{Migrant Household}_{i,c} + \delta' X_{i,c} + \lambda' Z_c + \varepsilon_{i,c} \tag{4.3}$$

where Migrant $\text{Household}_{i,c}$ is a dummy variable taking the value 1 if child *i* lives in a household with a household member who has ever migrated to the United States, and 0 otherwise; $X_{i,c}$ are a set of characteristics of child *i*'s household, such as the age and education of the child's mother and household size.[6] Z_c are a set of community controls at the state level, which in this case are information on the infant mortality rate in 1930; the current level of doctors, nurses, hospitals, and hospital beds per 1,000 inhabitants; and state gross domestic product (GDP) per capita. As discussed above, the migration dummy variable is instrumented with the 1924 historic migration rate in the state child *i* is living in. Because many of the outcomes considered are binary outcomes, such as whether a child died or not, probit and IV-probit methods are used.[7]

The ENADID enables us to construct several health outcome measures. Mothers are asked questions about their fertility history, and then asked more detailed information about their last two births since January 1, 1994, including the birthweight in kilograms of the baby. The four health outcomes we consider are as follows: infant mortality, defined in the standard way as a live birth dying during the first year of life; child mortality between ages 1 and 4 inclusive; birthweight in kilograms; and low birthweight, defined according to the international standard of whether or not the birthweight was below 2.5 kilograms. Birthweight is an important early indicator of child health. Low birthweight has been linked to a higher likelihood of cognitive and neurological impairment that limits the returns to human capital investment later in life, while higher birthweight has been found to be associated with greater schooling attainment and better labor-market payoffs (Wolpin 1997; Behrman and Rosenzweig 2003).

The top panel of table 4.1 presents the estimated coefficient on being in a migrant household from equation 4.3 for each of these four health outcomes. Standard probit estimation, which treats migration as exogenous, shows a small, negative, and insignificant effect of migration on infant mortality. After instrumenting for migration, we find a strong significantly negative effect.[8] Children born in a household with a migrant member are estimated to be 3 percent less likely to die in their first year than children born in similar households without migrant members. The effect is much weaker in magnitude for child mortality, with children in migrant households having a 0.5 percent lower chance to dying when between the ages of 1 and 4. Migration is also estimated to raise birthweight by 364 grams, or 0.64 of a standard deviation, lowering the probability of being born underweight by 5.4 percent.

Both the infant mortality and birthweight results show stronger improvements in child health from migration after instrumentation. Failure to consider the selectivity of migration therefore understates the impact of migration. This suggests that, in the absence of migration, children in what are currently migrant households would have poorer health status than children in observationally similar nonmigrant households. From this we infer that on net, Mexican migrants to the United States are negatively selected in terms of the health status of their children.

The ENADID survey also provides information on several health inputs during the time of birth and during infancy. The lower half of table 4.1 presents the estimated impact of migration on health input use, based on the estimation of equation 4.3 for health inputs rather than outcomes. Children in migrant households

TABLE 4.1 The Impact of Migration on Health Outcomes and Health Inputs

	Coefficient on being in a migrant household			
Dependent variable:	OLS	2SLS	Probit	IV-probit
Health Outcomes				
Infant mortality under age 1			−0.003 (0.96)	−0.030 (3.97)**
Child mortality between ages1 and 4			−0.002 (3.08)**	−0.005 (2.70)**
Birthweight in kilograms	0.069 (4.00)**	0.364 (2.79)**		
Low birthweight			−0.021 (2.81)**	−0.054 (2.59)**
Health Inputs/Health Care				
Child was delivered by a doctor			0.065 (3.21)**	0.300 (13.26)**
Child was breastfed			−0.017 (2.51)*	−0.192 (5.56)**
Child received all vaccines			−0.000 (0.01)	−0.108 (2.58)**

Source: Hildebrandt and McKenzie 2004, tables 5,6, and 7.

Note: All regressions include characteristics of the mother (age, education), household demographic controls, and community characteristics. Probit coefficients are marginal effects. Robust t-statistics in parentheses clustered at the state level. 1924 state migration rate is used as instrument for being in a migrant household. OLS = ordinary least square; 2SLS = two-stage least squares.

* significant at 5 percent; ** significant at 1 percent.

are found to be 30 percent more likely to be delivered by a doctor, but 19 percent less likely to be breastfed and 11 percent less likely to have received all of their recommended vaccinations for tuberculosis, diphtheria, polio, and measles. It therefore seems that migrant children are receiving less preventive health care in their infancy.[9] Nevertheless, as we have seen, migrant children are still slightly less likely than nonmigrant children to die between ages 1 and 4, so the positive effects of migration on health outweigh any negative impact from less preventive care at this age.

Remittances or repatriated savings will allow migrant mothers to have the ability to buy more food, increasing the nutritional inputs. The more frequent use of doctors for child delivery is also likely to be due at least in part to a greater ability to pay for medical services as a result of remittances. However, one would expect households receiving remittances to also generally increase purchases of other health inputs, so the decline in preventive care during infancy is not likely to be due to remittances. Although we do not have direct time allocation information to allow us to verify this theory, a likely explanation is that there is a higher opportunity cost of time for migrant parents, and periods during which one or both parents are absent from the children, making it more difficult to breastfeed and take the child to health clinics.

In addition to causing a change in time inputs into health production, migration may affect child health beyond its remittance effect by improving maternal health knowledge. This may come about through exposure to different health practices and information about contraceptive practices, the importance of sanitation, and knowledge about diet and exercise. Hildebrandt and McKenzie (forthcoming) construct an index of maternal health knowledge, based on detailed questions asked in the ENADID about knowledge of contraceptive practices.[10] They show that this index is associated with mothers knowing more about the causes of diarrhea. The index directly measures fertility knowledge and is likely to be a reasonable indicator of general child health knowledge among mothers. Moreover, higher levels of this health knowledge measure are associated with lower rates of infant mortality and higher birthweights.

Table 4.2 presents the estimated impact of migration on maternal health knowledge. After instrumenting, we find a strong effect of migration: being in a migrant household is estimated to increase health knowledge by 0.65 standard deviations. Because health knowledge is likely to be gained directly by the migrant member, and then passed on in part to other household members, we would expect to see a much larger increase in maternal health knowledge if the mother herself has migrated. Columns 3 through 6 of table 4.2 show that this is the case: the gain in health knowledge is 3.8 times as large when mothers migrate as when the father migrates. Hildebrandt and McKenzie (forthcoming) show that there appears to be evidence of knowledge spillovers from migrant to nonmigrant households. A one-standard-deviation increase in the proportion of households in a community with migration experience is estimated to lead to a 0.11 standard deviation increase in health knowledge of mothers in nonmigrant households.

In addition to the health improvements one would expect from the rise in income and wealth after remittances, migration is therefore seen to have a number of additional impacts on child health. Migration is found to increase the health knowledge of mothers, with smaller spillover benefits for the health knowledge of mothers in nonmigrant households. However, migrant children are found to be less likely to be breastfed or fully vaccinated, which is likely a result of a reallocation of time inputs with migration. Although child mortality between age 1 and 4 is not negatively impacted by migration on net, these results do suggest a need for

TABLE 4.2 The Impact of Migration on Maternal Health Knowledge
Dependent variable: Maternal health knowledge index

	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS	(5) OLS	(6) 2SLS
Migrant household	0.266 (4.01)**	1.289 (2.61)**				
Mother has migrated			0.473 (4.41)**	4.853 (2.45)*		
Father has migrated					0.238 (3.37)**	1.290 (2.51)*
Observations	12,744	12,744	10,676	10,676	12,489	12,489

Source: Hildebrandt and McKenzie 2004, table 8.

Note: Regressions are for women age 15 to 54 who gave birth between 1994 and 1997 and were the household head or spouse of the household head. All regressions also include a quadratic in mother's age, mother's years of schooling, household size, 1930 infant mortality rate, health infrastructure, and 1997 GDP per capita and a constant. Robust t-statistics in parentheses are clustered at the state level GDP = gross domestic product; OLS = ordinary least square; 2SLS = two-stage least squares.

* significant at 5 percent; ** significant at 1 percent.

further research into the long-term impacts of migration on health outcomes, as well as into investigating health policy actions that can enhance the ability of migrants to engage in preventive health care.

Impacts of the Migration Network on the Ability of Others to Migrate

International migration is costly, involving upfront monetary costs, information and search costs, opportunity costs in terms of income foregone while traveling and searching for work, and psychic costs (Massey 1988). The majority of rural Mexican migrants surveyed in our work migrate illegally on their first trip to the United States. Using the Mexican Migration Project (MMP), a survey of mostly high-migration communities, we calculate that, on average, 89 percent of first-time migrants between 1970 and 1990 were undocumented and an additional 7 percent were on tourist visas. In the 1997 ENADID survey, 91 percent of first-time migrants going to work in the United States had no legal documentation to do so. Crossing the border illegally is a risky and dangerous process, and migrants often rely on smugglers (*coyotes*) to help them cross. Orrenius (1999) reports the median cost of a coyote was $619 in 1994, having fallen over time. However, the Immigration and Naturalization Service (INS) estimates that the cost has increased substantially since then, especially following increased border enforcement after September 11, 2001, with prices reaching between \$1,500 and \$2,000 in 2002.[11]

Sociologists have emphasized that social networks can play an important role in lowering migration costs. Espinosa and Massey (1997) report that social networks play an important role in mitigating the hazards of crossing the border. Friends and relatives who have migrant experience often accompany new immigrants across the border or arrange coyotes. A reduction in migration costs has two main impacts on the decision to migrate (McKenzie and Rapoport 2004). The first is that it increases the ability of liquidity-constrained households to meet the costs of sending members to the United States. Second, lowering the costs of migrating increases the net benefit to households, which thereby increases the incentive to migrate. As a result, the impact of a larger migration network on the probability of migrating is predicted to vary with the level of household wealth.

We measure the size of the community migration network, with the migration prevalence ratio, defined by Massey, Goldring, and Durand (1994) as the "proportion of all members of a community age 15 and over who have ever migrated to the United States." As in most of the literature, this is a measure of relative network size.[12] Household resources are measured as the log of nondurable consumption (NDC),[13] which we denote by *lndc*. We then estimate the following regression for the probability of migrating, p.

$$p = \beta_0 + \beta_1 \times ndc + \beta_2 \times ndc^2 + \beta_3 \times \text{network} + \beta_4 \times ndc \times \text{network} + \varepsilon \quad (4.4)$$

We assume that the opportunity costs of migration, in terms of productive opportunities in Mexico, are increasing in wealth level, so that the richest individuals in a community are unlikely to wish to migrate. This accords with the sociological observation that the first migrants from a community are usually those with sufficient resources to afford the costs and risks of migrating, but who are not so affluent that foreign labor is unattractive (Massey, Goldring, and Durand 1994). Then we predict that $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 > 0$. When migration costs are relatively low, we further predict that $\beta_4 < 0$, so that additional reductions in migration costs increase the propensity for the poor to migrate.

The ENADID contains a wide range of community migration prevalence rates, allowing substantial variation in migration costs. At the 25th percentile only 3.8 percent of adults have ever migrated, compared with 15.9 percent of adults in the community with the median network size, and 35.6 percent of adults at the 75th percentile of network size. Data on NDC are only available for the current year. Current consumption of households that already have migrants will reflect the result of remittances and other impacts of migration. We therefore estimate equation 4.4 only for first-time migrants and estimate the probability that a male household head ages 15–49 migrated for the first-time within the last two years, which is conditional on his not having previously migrated.[14]

Columns 1 and 2 of table 4.3 present the results from estimating equation 4.4 with the full ENADID sample. The estimates presented here are from ordinary least squares (OLS) and two-stage least squares (2SLS) estimation, although IV-probit estimation gave similar results. The historic migration networks in 1924 are used as instruments for the current migration prevalence in a community. As predicted, the probability of migrating is found to first increase and then decrease with household resources, and to be higher in communities with larger networks. The interaction between network size and household resources is significant and negative, showing that a larger migration network (and hence lower migration costs) increases the probability of migrating more for the poor than the rich.

TABLE 4.3 Network Size and Probability of Migration
Probability of Household Head First Migrating in Survey Year or Year prior to Survey Year

	Full sample		Low network sample	
	(1) OLS	(2) IV-probit	(3) OLS	(4) IV-probit
Log nondurable consumption log NDC	0.3309	0.3281	0.0775	0.0833
	(3.43)**	(3.20)**	(1.43)	(1.51)
Log NDC squared	−0.0194	−0.0188	−0.0046	−0.0049
	(3.46)**	(3.10)**	(1.45)	(1.50)
Migration prevalence	0.7749	1.2253	0.3443	0.3057
	(4.64)**	(2.70)**	(0.48)	(0.29)
Migration prevalence log NDC*	−0.0788	−0.1314	−0.0274	−0.0332
	(4.14)**	(2.53)*	(0.32)	(0.28)
Observations	11,315	11,315	5,499	5,499
Communities	214	214	90	90

Source: McKenzie and Rapoport 2004, table 4.

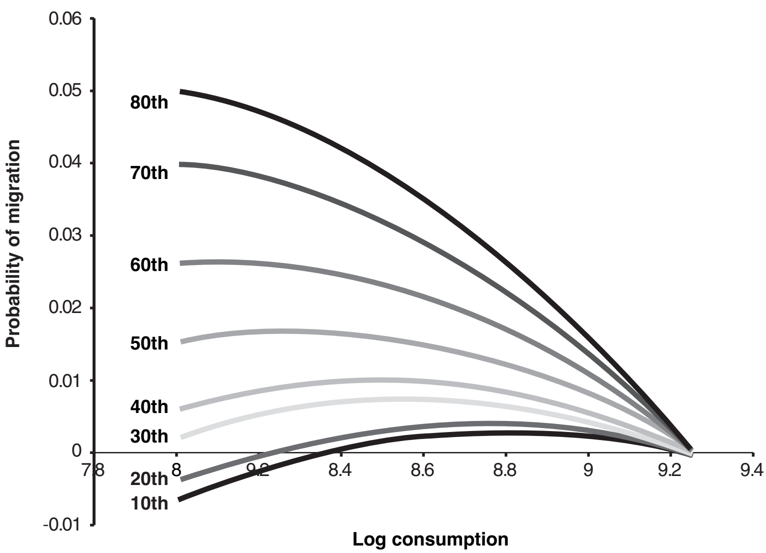
Note: T-statistics in parentheses with standard errors clustered at the community level. For male household heads ages 15 to 49 who have not previously migrated. Instruments are the 1924 state migration rate and its interaction with log NDC. OLS = ordinary least square.

* significant at 5 percent; ** significant at 1 percent.

If migration costs are relatively high, then a small reduction in costs might actually benefit the upper-middle range of the wealth distribution more than the bottom, because the incentive effect of lower costs will induce more migration from those who can afford the costs. One should therefore expect to find β_4 to be less negative, or even positive, when equation 4.4 is only estimated for communities with small networks. Columns 3 and 4 of table 4.3 examine this hypothesis by restricting estimation to the 40 percent of ENADID communities in which 10 percent or less of the adults have ever migrated to the United States. The interaction between network size and household resources is seen to become less negative, and is insignificantly different from zero for this subsample.

Figure 4.1 then plots the estimated relationship between migration and log NDC for different deciles of the ENADID community migration prevalence distribution using the estimates in column 2 of table 4.3. When migration networks are small, the probability of migration first increases and then decreases with household resources. Increasing the network size from this low level shifts the turning point to the right, and so the upper-middle range of the consumption distribution benefits most from increasing the network. Once the network gains suf-

FIGURE 4.1 Estimated Probability of a Household Head Migrating by Household Consumption Level at Different Deciles of the Community Migration Prevalence Distribution



Source: McKenzie and Rapoport 2004, figure 4.6.

ficient size, the turning point begins to move left, and at high levels of migration networks, one sees a declining propensity to migrate with wealth.[15]

These results show that migration by some members of a community can have large effects on the likelihood of other members of that community migrating. This impact is not through remittances, but through migration networks that lower the costs of migrating and increase the benefits of migrating to other community members. The new wave of migrants that follows will then be likely to send remittances, help additional community members to migrate, and encourage several of the other impacts of migration studied in this chapter.

Migration and Inequality in the Sending Community

The previous section showed that the network effects of migration affect the selection of who migrates. Poor households in a community with a large migration network are much more likely to migrate, and hence to send remittances, than poor households in a community with a small migration network. As a consequence, the size of the migration network will be a key factor in determining how remittances affect inequality in a community. In particular, when migration networks are small, and migration costs high, households at the upper-middle range of the wealth distribution in a community will be most likely to send migrants, and their remittances and repatriated income may therefore increase inequality. However, as migration networks increase, increasing numbers of household in the lower part of the income distribution will also be able to send migrants, and the increased income of these households should act to lower inequality.

The relationship between the level of migration in a community and inequality within that community is examined through a regression of the Gini coefficient of NDC in community i, Gini_i on the migration prevalence in that community, denoted Mig_i and other community characteristics, Z_i.

$$\text{Gini}_i = \alpha_0 + \alpha_1 \times \text{Mig}_i + \alpha_2 \times \text{Mig}_i^2 + \alpha_3 \times Z_i + u_i \qquad (4.5)$$

Table 4.4 presents the estimates of equation 4.5. The quadratic shows a positive coefficient on migration and a negative coefficient on squared migration, which suggests that migration first increases inequality and then lowers inequality at higher levels of migration. However, the coefficients are not significant, and so we drop the quadratic term from the model. For the full sample of communities, migration is estimated to lower inequality, although this effect is not significant at the 10 percent level. We next split the sample into low-migration and high-migration communities, again using a cutoff of 10 percent of adults having ever

Table 4.4 The Impact of Migration on Consumption Inequality in ENADID Communities
Dependent Variable: Gini of Nondurable Consumption

	Full sample			Low network sample		High network sample	
	(1) OLS	(2) IV-probit	(3) IV-probit	(4) OLS	(5) IV-probit	(6) OLS	(7) IV-probit
Migration prevalence	−0.013 (2.37)*	0.088 (0.82)	−0.018 (1.60)	−0.008 (0.12)	0.032 (0.17)	−0.011 (1.38)	−0.044 (1.76)
Migration prevalence squared		−0.193 (0.96)					
Proportion of heads age < 30	0.041 (1.66)	0.047 (1.93)	0.037 (1.78)	0.015 (0.37)	0.006 (0.18)	0.068 (2.51)*	0.087 (3.68)**
Proportion of heads age > 60	0.041 (2.28)*	0.048 (2.19)*	0.061 (3.58)**	0.035 (0.96)	0.046 (1.31)	0.051 (2.89)**	0.064 (4.11)**
Proportion of heads with education < 6 years	0.031 (1.46)	0.038 (1.83)	0.024 (1.44)	0.007 (0.24)	0.004 (0.20)	0.058 (2.88)**	0.068 (3.62)**
Proportion of heads with education at least 9 years	−0.005 (0.20)	−0.005 (0.21)	−0.004 (0.18)	−0.013 (0.39)	−0.009 (0.36)	0.012 (0.54)	0.009 (0.34)
Constant	0.373 (18.48)**	0.360 (18.78)**	0.372 (22.99)**	0.394 (13.27)**	0.390 (17.47)**	0.346 (19.46)**	0.347 (18.69)**

F-stat for first stage migration prevalence		35.88	71.92		12.26		16.80
F-stat for first stage migration prevalence squared		30.50					
Observations	214	214	214	90	90	124	124

Source: McKenzie and Rapoport 2004, table 7.

Notes: T-statistics in parentheses with robust standard errors. Instrument set B uses the 1924 state migration rate (and its square in column 2). The low-network sample includes municipalities with migration prevalence less than 0.10, high-network municipalities have prevalence greater than 0.10. OLS = ordinary least squares.

* significant at 5 percent; ** significant at 1 percent.

migrated to the United States. Migration is found to have a positive, but insignificant effect on inequality in low-migration communities, and a negative effect on inequality in high-migration communities, which is significant at the 10 percent level. The estimated magnitude of the impact on inequality is relatively large, with a one-standard-deviation increase in migration prevalence leading to a 0.5 standard deviation reduction in inequality.

McKenzie and Rapoport (2004) provide further supporting evidence for migration having nonlinear effects on inequality. Using the MMP, they find migration lowers inequality by more than in the ENADID. Using a small panel of communities observed in both the 1992 and 1997 ENADIDs, they find moderate support for an inverse-U-shaped relationship between migration and inequality by examining the association between changes in migration and changes in inequality over a five-year period.

Taken together with the results of the previous section, these results show that migration networks help determine the impact of remittances and migration on inequality. The migrants from communities with low networks are likely to be relatively rich, so that transfers to their families will increase inequality, at least between the poor and middle class. However, the migration networks formed within communities act, over time, to increase the set of households who can migrate, allowing poorer households to begin sending migrants. Remittances from such households will tend to lower inequality.

Migration and Incentives for Education

Empirical research on remittances and schooling has stressed the potential for remittances to raise schooling levels by increasing the ability of households to pay for schooling. Recent examples include Cox Edwards and Ureta (2003) who find that remittances lower the likelihood of children leaving school in El Salvador; Yang (2004) who finds greater child schooling in families whose migrants receive larger positive exchange rate shocks in the Philippines; and Lopez Cordoba (2004) who finds municipalities in Mexico that receive more remittances have greater literacy levels and higher school attendance among 6 to 14 year olds.

A recent, largely theoretical, body of literature on the "brain gain" has suggested that migration may have an additional positive impact on education by increasing the returns to schooling and thereby improving the incentives to acquire education (for example, Mountford 1997; Stark, Helmenstein, and Prskawetz 1997; Beine, Docquier, and Rapoport 2001). In ongoing work, McKenzie and Rapoport (2005) suggest that migration may actually have a disincentive effect on education in Mexico. The Mexican income distribution is more unequal than the U.S. income distribution, so one might actually expect higher marginal return to schooling in Mexico than in the United States. Chiquiar and Hanson (2005) provide evidence to support this, showing higher returns to education in Mexico than for Mexicans in the United States. As a result, individuals who intend to migrate may decide to accumulate less education in Mexico. This may occur as a result of direct substitution, with individuals migrating at an age at which they would otherwise be in school. However, it may also arise from individuals who plan to migrate making the decision to drop out of school now, because the effective returns to education are now lower.[16]

The effect of migration on education should then vary according to the level of education that children would undertake in the absence of migration. A child who would drop out of school after six years of primary education in the absence of the possibility to migrate should be much less affected by the lower returns to schooling when migration becomes possible than a child who would complete lower-secondary education (grades 7 to 9) and perhaps high school (grades 10 to 12) when migration is not an option. A mother's education is a strong predictor of the education of their children, and it is also highly correlated with household wealth. In the absence of migration, we would therefore expect children of more highly educated mothers to obtain more years of schooling. We therefore allow the impact of living in a migrant household on $S_{i,c}$, the years of schooling completed by child i in community c, to vary with the level of maternal education.

$$S_{i,c} = \lambda_0 + \lambda_1 \text{Mig}_{i,c} \times \lambda_2 \text{Mig}_{i,c} \times \text{MidEduc}_{i,c} + \lambda_3 \text{Mig}_{i,c} \times \text{HighEduc}_{i,c} \\ + \alpha_1 \text{MidEduc}_{i,c} + \alpha_2 \text{HighEduc}_{i,c} + \phi' X_{i,c} + \gamma' Z_c + \varepsilon_{i,c} \quad (4.6)$$

where MidEduc and HighEduc are dummy variables for child i having a mother with three to five years of schooling and six or more years of education respectively; $X_{i,c}$ are a number of child controls, such as age and age squared; and Z_c are the set of state-level controls. Thirty-four percent of children have mothers with zero to two years of education, 26 percent have mothers with three to five years of education, and 40 percent have six or more years education.

Table 4.5 presents the results of estimating equation 4.6 separately for boys ages 16 to 18 and girls ages 16 to 18. First, when we do not allow the effect of migration to vary with maternal education, columns 3 and 7 show an overall impact of migration lowering years of education completed by 1.4 years for boys and 1.7 years for girls.[17] Columns 4 and 8 allow the impact of migration to vary with maternal education. Migration is seen to have a significantly larger negative effect for children of highly educated mothers. Migration lowers completed years of education by 3.05 years for boys with mothers who have six or more years of education. This has the effect of completely erasing the boost in education that we

TABLE 4.5 Impact of Migration on Years of Schooling

	Males Ages 16 to 18				Females ages 16 to 18			
	(1) OLS	(2) OLS	(3) IV-Probit	(4) IV-Probit	(5) OLS	(6) OLS	(7) IV-Probit	(8) IV-Probit
Child is in a migrant household	−0.3965 (2.21)*	0.0261 (0.07)	−1.4017 (2.91)**	−0.9404 (2.12)*	−0.0970 (0.47)	0.5850 (2.37)*	−1.7059 (1.45)	−1.9298 (2.09)*
Migrant household* mother has 3 to 5 years schooling		-0.4151 (1.09)		−1.0820 (1.40)		−0.7663 (2.51)*		−1.0127 (0.87)
Migrant household* mother has 6 or more years schooling		−0.5498 (1.53)		−2.1113 (2.04)*		−1.1656 (3.98)**		−2.4555 (2.15)*
Mother has 3 to 5 years schooling		1.0784 (7.57)**		1.3074 (6.22)**		1.2040 (6.24)**		1.2415 (3.19)**
Mother has 6 or more years schooling		2.4809 (18.15)**		2.7563 (9.69)**		2.7650 (17.90)**		2.9581 (9.85)**
Observations	3,336	2,930	3,336	2,930	3,332	2,539	3,332	2,539

P-value for testing the impact of migration is zero by mother's education:							
Mother has 0 to 2 years of education		0.941		0.034	0.025		0.037
Mother has 3 to 5 years of education		0.040		0.001	0.516		0.011
Mother has 6 or more years of education		0.015		0.003	0.346		0.036

Source: McKenzie and Rapoport (2005), tables 4 and 5.

Notes: All regressions also contain a constant, age and age squared, and controls for population size, historic levels of inequality and schooling, and school infrastructure. T-statistics are in parentheses with standard errors clustered at the state level. Instruments are 1924 state-level migration rate and its interaction with mother's year of schooling categories. OLS = ordinary least squares.

* significant at 5 percent; ** significant at 1 percent.

would otherwise predict from having a highly educated mother and, in practice, means that on average these children only complete elementary school, instead of carrying out three years of lower-secondary education. The magnitude of the estimated effect is even worse for girls, with a reduction of more than four years of education for children of the more highly educated mothers in migrant households. However, we can not reject equality of the effect for boys and girls.

The negative impact of migration on child schooling is in stark contrast to the increase in education one would expect from remittances. Basic education is provided for free by the state in Mexico, and, coupled with government programs that target education of the poor, it is possible that liquidity constraints are not a major factor in the education decision. Several explanations for the negative impact of migration on child education are suggested. The first is that children ages 16 to 18 migrate to obtain work instead of going to school, or migrated with their adult parents and, as a result, dropped out of school. There is some evidence of this for male children. A second explanation is that the future returns to schooling are now lower for children who are likely to migrate, and so education aspirations are lower. A third explanation is that the absence of migrant parents results in less supervision of children and, perhaps, in the need for children to undertake household work in place of migrant adults. This may explain the reduction in schooling of girls, who are less likely to migrate than boys. In our ongoing work, McKenzie and Rapoport (2005) seek to disentangle these explanations further.

Conclusions and Directions for Further Research

This chapter has shown that migration has a number of impacts on households that cannot be directly attributed to remittances. As a result of migration, children are less likely to be breastfed or less likely to receive their full schedule of vaccines, but migration increases the level of health knowledge of mothers. Migration by some community members has spillover effects to other community members. The migration networks formed increase the likelihood of other community members also migrating, with different impacts across the wealth distribution depending on the size of the network. As a result, migration can cause inequality in the sending community to first increase, and then later decrease, as the network gets larger. Finally, it was shown that migration lowers the education attainment of children of more highly educated parents, which is likely to be due to the combination of parental absence arising from current migration, as well as from lower future returns to schooling for children who intend to migrate.

Estimates of the effect of remittances that compare households receiving remittances with households not receiving remittances are therefore likely to be biased because of these other impacts of migration. It appears that if one wishes to isolate the effects of remittances from other impacts of migration, one needs to think of factors that determine whether a migrant decides to remit, and how much they remit, which are not determinants of the migration decision. The historic migrant networks used in this chapter do not fit this criterion. Future research on the impact of remittances should therefore focus on trying to identify exogenous reasons why one migrant will remit more than an otherwise similar migrant. Two possible reasons may be exogenous variation in the transfer costs among migrants to send remittances,[18] and labor market shocks varying across migrants in different destinations.[19]

Annex 4.A Econometric Issues in Identifying the Impact of Migration and Remittances

Estimation of equation 4.1 or 4.2 by ordinary least squares (OLS) regression assumes that all systematic differences between remittance-receiving and non-remittance-receiving households can be explained by a set of observable characteristics of the migrant, receiving household, and community. This approach is not satisfactory, because if the two groups of households (remittance receivers and nonreceivers or migrant households and nonmigrant households) are really the same after controlling for observable differences, they should have the same migration and remittance behavior (LaLonde and Topel 1997). In particular, one is usually concerned that the fact whether a household receives remittances or sends a migrant may be correlated with unobserved variables that also affect the outcome of interest.

There are two main categories of concern: unobserved shocks and unobserved attributes of the household. As an example of the first concern, consider using equation 4.1 to estimate the impact of remittances on child health outcomes, such as weight-for-age. It may be that a household that experiences a negative health shock, such as sudden illness of a child, is likely to request remittances from relatives abroad to help pay for treatment. Because the researcher is unlikely to be able to precisely observe all such health shocks, the estimation of equation 4.1 by OLS may understate the effect of remittances.

The second concern is that households that send migrants and receive remittances differ in terms of motivation, ability, concern for their children, and other such hard-to-measure attributes. For example, consider using equation 4.2 to measure the effect of migration on child schooling. A poor household that particularly values schooling may decide to send a migrant to earn remittances to be able to pay for schooling, and also undertake a number of other actions to help their children with schooling. In such a case, estimation of equation 4.2 will overstate the impact of migration on schooling.

One solution to this problem is to employ the method of instrumental variables. The idea is to find a variable (the instrument) which helps predict either remittances or migration, but it does not otherwise have an impact on the outcome of interest. There is a sizeable body of literature that looks at the empirical determinants of remittances and migration.[20] However, most of the variables that help predict whether a household member migrates, or whether a household receives remittances, are likely to have an impact on the outcomes of interest. For example, the household head's age and education, and the income and demographic composition of a household, may help predict whether they receive remittances, but they will also affect the health and education of their children and other outcomes of interest. We follow Woodruff and Zenteno (2001), who suggest that historic migration networks (formed as a result of the pattern of development of the railroads in Mexico) may be used as a valid instrument to examine the impact of migration on microenterprises in Mexico. Historic migration networks made it easier for others in the same communities to migrate, and as a result, the state-level migration rate in 1924 helps predict whether a particular household will contain a migrant member today.

The assumption required for this approach to work is that these historic migration rates have no impact on the outcomes of interest, such as child health, inequality, and education, other than through current migration. This assumption would be violated if there were persistent community characteristics that influence migration and the outcomes of interest both historically and today. For example, in the case of child health, a concern might be that certain states have always had a bad disease environment, which led people to migrate both in the past and today, and that also affects disease outcomes. Hildebrandt and McKenzie (forthcoming) show that this does not appear likely in the case of child health, because infant mortality rates in the 1930s are statistically independent of historic migration rates. McKenzie and Rapoport (2004, 2005) likewise show their results to be robust to the inclusion of controls for historic inequality and historic schooling levels.

Historic migration rates can therefore be used as an instrumental variable in equation 4.2, allowing us to determine the impact of migration on a variety of outcomes. Can we then also use historic migration networks as an instrument in equation 4.1 to identify the causal impact of remittances on Mexican households? This requires assuming that historic migration networks affect the outcomes of interest *only through remittances*, and are therefore uncorrelated with the error term ε in equation 4.1. Because we have argued that historic migration networks help predict current migration, this amounts to assuming that the only impact of migration on the outcome of interest is through remittances. However, as this chapter has shown, this does not appear to be a tenable assumption.

Identifying the effect of remittances, as distinct from the overall impact of migration, therefore involves a second level of complexity. We must find a variable that not only helps determine why one household migrates and another with similar observable characteristics does not, but that also explains why one family with a migrant household member receives more remittances than another similar family that also has a migrant member. Variables that help predict migration, such as migrant networks or institutional arrangements such as migrant quotas, do not appear to be suitable for predicting why one migrant will send more remittances than another similar migrant. This chapter's conclusion discusses potential approaches that could be used in further research to try to separately isolate the remittance impact.

Endnotes

1. See Durand and Massey (1992) for a review of such studies in the case of Mexican migration.
2. Some examples include Adams (1991), Taylor and Wyatt (1996), and Cox-Edwards and Ureta (2003).
3. Migrant networks are also likely to be important in large cities, but in these areas the neighborhood network rather than the whole city network is likely to be most relevant. Unfortunately the surveys used here do not allow for close study of neighborhood networks.
4. We thus include return migrants and migrants with family members remaining, but we are not able to include cases in which the whole household migrates and does not return. This is an issue in almost all migration surveys, although it is less common for the whole household to migrate in rural areas. Moreover, because many of our results concern the impact of migration on remaining household members, it does not appear to pose a severe problem for our work. The survey does not reveal whether households have deceased members who were prior migrants. The effect of any such misclassification would be standard measurement error bias, which would tend to make us less likely to detect significant impacts of migration. However, it is likely that the proportion of households whose only migration experience is through a deceased member is low and hence will have little substantive impact on our results.
5. It is also possible that migration may have an impact on the disease environment. An example is the transmission of the HIV/AIDS virus by migrant workers in some regions of Africa.
6. Note that household income is not included in these characteristics. Household income is a function of migration because of the impacts of remittances and changes in household labor supply induced by migration. Including income directly would therefore remove several of the key channels through which migration affects health outcomes. Hildebrandt and McKenzie (2004) discuss in more detail identification of the channels through which migration operates.
7. Two-stage least squares (2SLS) gives very similar results for health outcomes (see Hildebrandt and McKenzie 2004).
8. The first-stage equation in all the instrumental variables specifications used in this chapter always shows the historic migration rate to be a strong instrument for current migration. See Hildebrandt and McKenzie (2004) and McKenzie and Rapoport (2004) for details.

9. Breastfeeding is associated with a number of positive health outcomes and is recommended by the World Health Organization.

10. The index is the first principal component from answers to 10 questions about knowledge of contraceptive methods. The index has mean zero and standard deviation of 1.98.

11. Source http://www.migrationint.com.au/ruralnews/guam/jul_2002-15rmn.asp. Accessed January 25, 2005.

12. See Bauer, Epstein, and Gang (2002) for a discussion of alternative measures of network size. Identification of both relative and absolute network size effects requires more instruments than we have available, and therefore we follow the existing literature in preferring relative network size.

13. This is predicted from household characteristics and asset indicators using the Mexican National Income and Expenditure Survey. See McKenzie and Rapoport (2004) for details.

14. Similar results were obtained using all first-time male migrants, rather than just heads.

15. Note that the interaction term in column 2 of table 4.3 is significant, so the turning points shown in figure 4.1 are significant.

16. An additional possible explanation that our ongoing work will investigate is that children of migrant parents may have lower schooling because of the effects of parental absence.

17. The mean effect is not significant for girls, but it is for boys.

18. Gibson, McKenzie, and Rohorua (2005) estimate the elasticity of remittances with respect to the costs of sending and find suggestive evidence for sizeable increases in remittances when costs fall.

19. McKenzie and Rapoport (2004) try using demand shocks in U.S. labor markets as instruments for migration stocks, but they find they have little predictive power. Such demand shocks would be likely to have better power at predicting remittance flows. Yang forthcoming comes closest to this approach in the Philippines, but notes that the exchange rate shocks he considers are likely to also have wealth effects that prevent them from picking up the pure remittance impact.

20. See Rapoport and Docquier (forthcoming) for an overview of motives to remit.

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