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THE IMPACT OF MIGRATION AND REMITTANCES ON DISTRIBUTION AND SOURCES INCOME: THE MEXICAN RURAL CASE*

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*The view expressed in the paper do not imply the expression of any opinion on the part of the United Nations Secretariat.

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A. INTRODUCTION

International migration has become a central component of world economic globalization and it has emerged as a predominant factor in international relationships. The transnational migration phenomenon has affected individuals, communities and countries. It has also been reflected in some aspects of international politics. These relationships are worthy of being taken into account in the political economic decision-making.

The number of international migrants increased in recent years. For instance, between 1965 and 1995, the number increased from 75 to 125 million (UNDP, 1999). In 1990, international migrants constituted 2.3% of the world population. The United Nations indicates that in 2002, the number of people working outside of their country of birth was nearly 175 million. With these numbers it is possible to assert that migrants are nearly 3% of the world population (United Nations, 2002).

In the developing countries, remittances have become a significant source of income and financing. According to the International Monetary Fund (IMF, 1999), migrant remittances have increased from 45.7 billion dollars in 1990, to 66.2 billion dollars in 1998.[i]

In 1998, Latin American and Caribbean countries received 13 billion dollars from remittances. Mexico occupied first place in the region with more than 40% of those remittances -having 1.9 billion dollars in 1990 and 6.2 billion in 2000. In 2003, Mexico gained 13.2 billion dollars (a great growth of 35.16% with respect to the previous year). The income from remittances even surpasses foreign direct investment and is equal to 79% of the oil exports (Banco de México, 2003).

Because a great proportion of households that receive remittances are in rural areas of Mexico, and because these households are also important suppliers of the labor force allocated for migration, current research has focused on the Mexican rural case, particularly in communities with less than 2500 and more than 500 inhabitants. According to the 2000 Census (Censo General de Población y Vivienda 2000), 24.4% of the population is in these communities (INEGI, 2000).

The following research is based on a representative household survey of the Mexican rural sector. The principal objective of the research is to determine the impact of migration and remittances on rural households' income sources, as well as the implications of these impacts on the income distribution of the source communities.

In general terms, it is well known that developing countries present flaws in certain types of markets. Clear examples are the markets of insurance and credit. The phenomenon of migration can play a central role in solving the problems of liquidity caused by the lack of well developed financial markets (Lucas, 1987; Rozelle et al., 1999). The new economics of labor migration (NELM) analyze the migration phenomenon from a perspective that involves the process of decision-making at the household level instead of at the individual level. A hypothesis delineated by this theory implies that households facing imperfect markets decide to participate in migration like part of a group of economic decisions associated to this lack of markets (Stark and Bloom, 1985; Taylor and Martin, 1998).

When a household decides to allocate some of its members to the migratory activities, it is simultaneously carrying out production decisions in the short-term as well as in the long-term. Two opposing impacts of migration on labor-supplying households can be identified. The first is the negative effect on the local household production, due to the decrease in the household's labor offer. The second positive impact would be the inflow of remittances from the migrants to their origin communities. The net impact may be determined using quantitative analysis (Yúnez, 2001).

With the aim of testing a set of hypothesis as outlined by the NELM, this study will use data about migration in rural Mexico in order to address the following questions: i) When migrants leave the household, does the reduction in the labor force cause a decrease in household revenues in the short run? ii) What are the effects of remittances on rural household income sources? iii) What happens to the income distribution in the labor force ejector communities? In other words, does it increase or decrease the income inequality in the rural households of Mexico? iv) Is migration an investment strategy of the households?

In order to accomplish these objectives, the paper is organized as follows. First, an analysis of the decomposition of the Gini coefficient by income source will be presented. With this analysis, it is possible to determine the impacts of remittances (national and international) on household income inequality. Then, a simple analysis based on the NELM will be presented. This will provide and understanding of how migration and remittances allow households' market restrictions either to relax or to tighten. Finally, a two stages model of simultaneous equations will be developed based on the NELM. The estimates will be used to measure the migration and remittances effects on the different household's income sources. In this manner, the present work represents a test of the NELM hypothesis that suggests that migration and remittances are an opportunity taken by the households to solve their restrictions of liquidity. Thus, it will be possible to explore the migration[ii] effects on rural Mexican households and their communities, and it will also provide evidence of the complex effects that migration has on a rural economy.

B. Inequality And Income Sources In Rural Mexico

1. Remittances and Inequality

Some researchers have examined the distributional impacts of migrant remittances by comparing income distributions including and excluding remittances (Barham and Boucher, 1998; Oberai and Singh, 1980; Knowles and Anker, 1981) or by using income-source decompositions of inequality measures (Stark, Taylor and Yitzhaki, 1986, 1988; Adams, 1989, 1991; Adams and Alderman, 1992). These studies offer conflicting results about the impact of remittances on inequality. Stark, Taylor and Yitzhaki (1986) provide a theoretical explanation for these conflicting findings. They argue that rural out-migration, like the adoption of a new production technology, entails costs and risks. Moreover, the costs and risks are likely to be especially high in the case of international migration. Given this fact, pioneer migrants tend to come from households at the upper-middle or top of the sending-area's income distribution (e.g., Portes and Rumbaut, 1990; Lipton, 1980), and the income they send home in the form of remittances is therefore likely to widen income inequalities in migrant-source areas.

Over time, information about migrant labor markets becomes diffused across sending-area households through the growth and elaboration of migrant networks (see Massey, Goldring, and Durand, 1994), much as new agricultural technologies become diffused across farms. If households at the middle or bottom of the income distribution gain access to migrant labor markets, the initial unequal effect of remittances may be dampened or reversed. Stark, Taylor and Yitzhaki (1988) found that remittances from international migrants had an unequalizing effect on the income distribution in a Mexican village that recently had begun to send migrants abroad, but an equalizing effect on another village that had a long history of participating in international migration.

The present research does not consider the migration diffusion hypothesis outlined by Stark et al. It only uses nationally representative data from rural Mexico to estimate the marginal effects of both international and internal migrant remittances on income inequality among Mexican rural households. To

test this hypothesis it is necessary to measure the income source Gini decomposition at regional or community level but that left for future study.

2. Income Source Gini Decomposition

In order to identifying the impacts of migrant remittances on rural income distribution, it is first necessary to select an inequality index. Of the various indexes that satisfy the five basic properties mentioned by Ray (1998), the Gini coefficient is probably the most intuitive with its neat correspondence to the Lorenz curve and easy-to-interpret decompositions of income effects. This is the measure used in the present study.

Lerman and Yitzhaki (1985) pointed out that the Gini coefficient for total income inequality, G, can be represented as:

$$G = \sum_{k=1}^{K} R_k G_k S_k \qquad (1)$$

where S_k represents the share of component k in total income, G_k is the source Gini, corresponding to the distribution of income from source k, and R_k is the Gini correlation of income from source k with the distribution of total income.

Using equation (1) it is possible to decompose the influence of any income component, in this case migrant remittances, upon total income inequality, as the product of three easily interpreted terms:

a) how important the income source is with respect to total income (S_k)
b) how equally or unequally distributed the income source is (G_k)
c) whether or not the income source is correlated with total income (R_k).

For example, if an income source represents a large share of total income, it may potentially have a large impact on inequality. However, if that income is perfectly and equally distributed ($G_k = 0$), it cannot influence inequality even if the magnitude is large. If this income from a source is large and unequally distributed (S_k and G_k are large), it may either increase or decrease inequality, depending upon which households, at which points in the income distribution, receive it. If remittances are unequally distributed and flows disproportionately towards households at the top of the income distribution (R_k is positive and large), their contribution to inequality will be positive. However, if remittances are unequally distributed but target poor households, remittances may have an equalizing effect on the rural income distribution, and the Gini index may be lower with remittances than without them.

Using the Gini decomposition, it is possible to estimate the effect of small changes in migrant remittances on inequality, holding income from all other sources constant. In order to do this, the Gini decomposition by income source proposed by Lerman and Yitzhaki (1985) is used. Considering a small percentage change in income from source k equal to ey_k where e is close to 1, it can be shown that the partial derivative of the Gini with respect to a percentage change e in source k is equal to:

$$\frac{\partial G}{\partial e} = S_k (R_k G_k - G) \qquad (2)$$

where S_k, G_k and R_k denote the source-k income share, source Gini, and Gini correlation. G denotes the Gini index of total income inequality prior to the income change. The percentage change in inequality resulting from a small percentage change in income from source k equals its initial share in inequality minus its share in total income.

3. Remittances, Market Restrictions and the New Economics of Labor Migration

The increasingly important migration phenomenon has induced development theoreticians to study migration from different perspectives. A wide range of migration studies already has certain bases to describe the observed population movement patterns in order to study the main migration determinants (Massey et al., 1993, 1994). However, several of these studies tend to research the phenomenon by itself and sometimes its total impact in the economy, neglecting the impacts that the migratory phenomenon has on the migrants' origin communities (some studies that consider this impact are, among other, Adams, 1989 and 1991; Barham and Boucher, 1998; Stark et al, 86, 88).

One of the most important differences between the neoclassical models of migration and those of the NELM is the analysis unit. On one hand, the neoclassical models (e.g. Todaro, 1969; and Harris and Todaro, 1970) consider the migration decisions from an individual perspective, ignoring one of the main motivations -sharing part of the migrants' revenues with their origin households. These types of models consider the individual as the fundamental unit of analysis and they ignore the family relationships that exist between the migrants and the households left behind.

On the other hand, the NELM considers that migration decisions are taken in the household context that involves family decisions. The NELM takes into account different individuals with different interests and different income accesses. This theory outlines that individuals act in a collective way at the household level with the objective to maximize their revenues, minimize the risks and diminish the restrictions created by diverse market failures (e.g. lack of access to capital, absence of a well developed labor market, etc.).

The hypotheses considered by the NELM recognize that migrants do not break their links with their source communities. In addition, members who stay behind tend to reorganize their consumption patterns and their productive activities based on their share of household migrants revenues. These behaviors show the necessity of analyzing the migratory phenomenon from a wider vision (at a household level) as opposed to studding only the behavior of the individuals who emigrate. Including these factors, will produce a more complete vision of the impacts of migration and remittances on Mexican rural communities.

The increasing use of models using incomplete markets has also been incorporated in studies of economic development. Consequently, new perspectives have arisen and have pointed out the complexity of the migration as an economic institution. Moreover, these perspectives have shown the complexity of the interrelations between the migration determinants and its impacts, as well as the households' role in the decision making process. Stark (1991) pointed out that migrants play the role of financial intermediaries, allowing the households to smooth their restrictions of risk and credit. Thus, the households would have capacity to make the transition from labor production to commercial production. Following Taylor et al. (2003), the next section presents a theoretical model that helps to understand a hypothesis put by NELM.

a. Theoretical Model

It is considered that a household has two possible productive activities, one with high returns and another with low returns (e.g. commerce and agriculture). This household can invest its fixed resources ($\overline{T}$), such as land or capital dedicated to a productive activity, in any of the two activities. With Q_i, $i=1,2$, the product of these two activities, respectively. Household characteristics, Z_h, shape the investments that the household carries out in each activity.

If it is assumed that the curve PP'(see figure I) represents the production possibility frontier (PPF), where its slope is determined by -μ, then at the range of relative prices such that, $|\mu| > |p_2/p_1|$, the household will specialize in the activity with higher returns, then product will be, $Q^* = f(\overline{T}, Z_h)$, and income $Y^* = g(Q^*)$.

Q* and Y* would be the result if the household does not face any kind of restrictions in the markets. However, if the household faces market restrictions when it is trying to invest in the higher revenues activity the following outcome is possible. Considering, $c(\cdot) = T_1$, where $c(\cdot)$ denotes one or more barriers that limit the investment of the household fixed resources to only T_1 ($T_1 < \overline{T}$). For example, in the case of a restriction of liquidity or credit, $c(\cdot)$ can denote a barrier that keeps the household from getting loans for the purpose of investing more in the higher returns activity. Consequently, the restriction prevents the production of more Q_2 due to the lack of access to the formal credit market. In this example, T_1 represents the portion of the household fixed resources that at that moment are used for the activity of highest returns. Although the household would prefer to produce more Q_2, the lack of liquidity obstructs this possibility.

The NELM points out that the role of remittances can soften rural households' market restrictions. This can be illustrated in the following way. Without a credit market, some members of the household could be allocated to the migration activity, M. These household members could help to relax the credit and liquidity restrictions by returning part of its income via the remittances, R. This relaxation of access to credit is accompanied by a cost. For instance, if the rural households face an imperfect labor market and they have to appeal to the family labor, migration can restrict the households when they try to move to the higher revenues activity.

The NELM establishes that the restriction limits the quantity of fixed resources that can be assigned for the production of higher revenues goods. In this manner, T_1 would be a function of migration and remittances, $c(M, R,) = T_1$. Also, it is hypothesized that $dc/dR > 0$ and $dc/dM < 0$, because migration causes a reduction in the family labor and an increase in the available capital for household production.

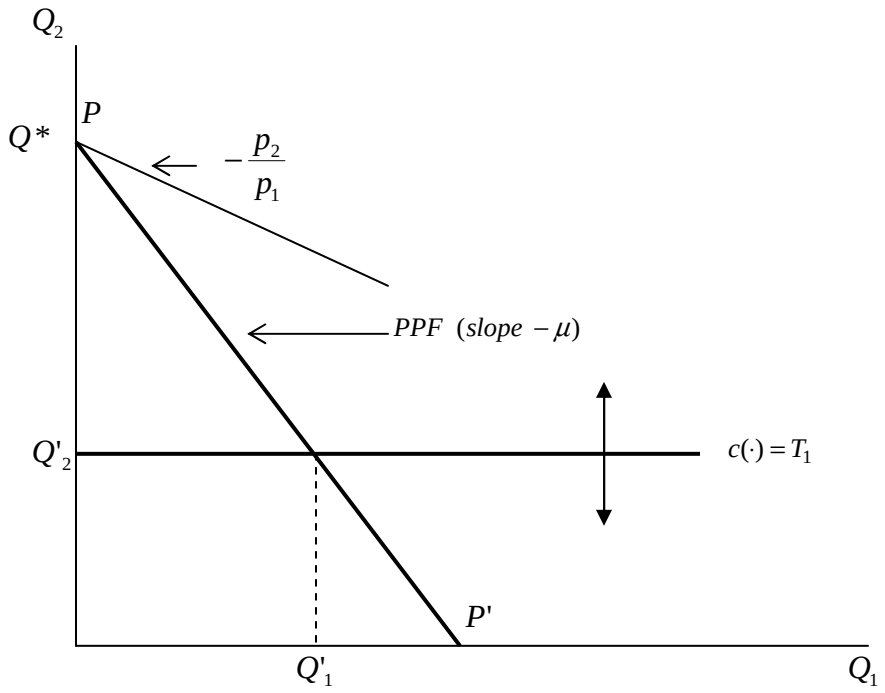
The product of the higher revenues activity, considering the restriction, is $Q'_2 = f(T_1, Z_h)$; and the product of the activity with lower revenues is $Q'_1 = f(\overline{T} - T_1, Z_h)$.

The restricted household income, $\overline{Y}$, is determined by:

$$\overline{Y} = g(Q'_2, Q'_1) \qquad (3)$$

where $\overline{Y} < Y^*$

Figure 1. Potential Migration Effects on rural households´production



Because the relative magnitudes of the derivatives $dc/dR > 0$ and $dc/dM < 0$ are unknown, the net migration effect on the households' total income is ambiguous. However, when the credit and/or human capital restrictions are present, the sign of those derivatives will be not equal to zero, in contrast to the rural household models that operate in an atmosphere of perfect markets (Singh et al., 1986).

Findings that show migration and remittances affect any households' income source significantly, would support the hypothesis of the NELM. The sign of the effect on migration in a specific activity, as the effect on total income, is uncertain *a priori*. In terms of figure I, migration and remittances could increase the production of the activity with high revenues (Q_2), if they relax the market restriction $c(\cdot)$, since it is what limits the expansion of the activity. However, this would imply a negative impact of migration on the product of the other activity Q_1, if it is assumed that the PPF is not affected by the migration. In a set of relative prices, the loss of restrictions probably causes an increase in the higher revenues activity production and therefore an increase in the income of such activity.

Previous studies have shown results supporting the main hypotheses proposed by the NELM (Stark and Bloom, 1985; Lucas, 1987; Stark et al., 1986; 1988; Taylor, 1992; Rozelle et al., 1999; Taylor et al., 2003). Those studies suggest that if the migrants play the role of financial intermediary, it is expected that migration and remittances impacts should not be null. Consequently it should also influence the income distribution in source communities. In order to investigate the previous hypotheses, the following econometric model will be used.

b. Econometric Model

The lack of well developed credit markets in rural Mexican communities gives rise to the assumption that the higher revenues production activities are restricted. In consequence, if the migration, M, and the remittances, R, affect the credit restrictions and therefore the production restrictions, then the vector of

restricted income sources will depend on M and R, as well other vectors of individual, household, and community level characteristics ($\mathbf{Z}_k$). Through production, the migration and remittances can have diverse effects on different income sources. This paper distinguishes between the effects of internal and international migration, as well as considering the effects of the remittances coming from these two main destinations.

Considering income sources such as agricultural income (Y_a)(including the production of basic, cash crops, and plantations); livestock income (Y_l), wage income (Y_w), government transfers (Y_t), and other incomes (Y_o)(including the income from commercial activities and services); and dividing the concept of remittances into national, R_n, and international, R_u, the sum of the two sources of remittances and the five sources of net revenues are equal to the total net income.

The central equation of the model that explains the net income generated by the household from each one of the sources is determined by:

$$\overline{Y}_k = \gamma_{0k} + \gamma_{1k} M_n + \gamma_{2k} M_u + \gamma_{3k} R_n + \gamma_{4k} R_u + \gamma_{5k} Z_k + \varepsilon_k ; \quad k = a, l, w, t, o \qquad (4)$$

The null hypothesis associated with the NELM is: Neither the remittances, R, nor the migration, M, affect the different income sources. In other words: $\gamma_{1k}, \gamma_{2k}, \gamma_{3k}, \gamma_{4k} = 0 \quad \forall \quad k$.

Although is well known that remittances are produced by the households' members allocated to labor migration, M, not all of households receive them. Given the migration, remittances are affected by the characteristics of households' human capital, $\mathbf{Z}_R$, which in turn influence the migrant's success and disposition to send remittances.

$$R_i = \alpha_{0i} + \alpha_{1i} M_i + \alpha_{2i} Z_{Ri} + \varepsilon_{Ri} \qquad i = n, u \qquad (5)$$

Migration is also a function of the characteristics at the individual, household, and community level, $\mathbf{Z}_M$; this function can generally be represented by

$$M_j = g_j(\beta; Z_M) + \varepsilon_M \qquad j = n, u \qquad (6)$$

In order to estimate consistently the system of equations (4) to (6), a functional form must be chosen for the equation (6). This functional form in (6) has to consider that the number of migrants is never a negative number. However, some aspects that complicate the estimate, according with the NELM, are that migration and remittances are endogenously determined with the other income sources. In order to control the endogeneity problems, instruments are needed to identify both remittances and migration. The selectivity bias also represents a problem, since not all the households sending migrants receive remittances and not all the households participate in the different income activities. Finally, the remittances and other income sources may suffer the same types of shocks, which would cause contemporary correlations among the equations.

In the migration equation certain factors beyond the non negativity should be taken into account. It shall be considered that an significant number of households do not send out migrants. For instance, in the West-Center region, 45% of the households did not report household members living in the United States, or any Mexican destinations. Meanwhile, a significant portion of the households which allocated migrants sent more than one individual. In this region, 37% of households reported more than one migrant either going to the interior of the country or toward the United States.

Considering the above, a functional form will be used, which counts the probable number of individuals migrants. This functional form for equation (4) is $g(\beta; Z_M) = \exp(\beta_0 + \beta_1 Z_M) + \varepsilon_M$. The count regression has several advantages over other possible estimators. For instance it takes into account the households that do not participate in migration, and it does not generate any negative predictions, like a lineal specification would do. It also considers the fact that some households have more than one migrant (Wooldridge, 2002).

In order to control for endogenity in the system of equations, in addition to the variables of human capital, migration was modeled as a function of migration networks, or contacts with neighbors that previously had migrated. Both theoretical and empiric research have shown that migration networks constitute one of the main factors that determine migration (Durand et al., 1996). The members of the community who have previously emigrated help to diminish the costs associated to migration as long as they share the information related to the job opportunities with their relatives or neighbors (Mckenzie and Rapoport, 2004). Therefore, the households in the communities with migratory histories or greater migratory tradition have better opportunities to place migrants.

The existence of migration networks in the source communities should not affect the level of remittances captured at household level, which depends on the decisions of the migrants of each household. In consequence, the existence of networks in the communities does not affect the different households' income sources inside the community. In order to capture this fact, two variables will be used to measure the migration networks; a dummy variable equal to 1 if the household head's father emigrated at some point in time, and 0 if he did not. Another variable equal to the number of household members in 1990 for each destination will be used.

The reasons to send remittances are complex (Lucas and Stark, 1985; Stark and Lucas, 1988). Besides the variables of human capital and other specific variables at the household level, remittances may be influenced by the community norms to send remittances (Massey, 1987, Taylor and Martin,1998). The average level of remittances among the families of the community is used as a Proxy for the migration community norm to remit, assuming that the community norm to send remittances affects the level of remittances of each household but does not have any impact on any particular household's income source.

Finally, the standards assumptions for the stochastic errors (ε_s, $s = a, l, w, t, o, R_i, M_j$) are assumed. After correcting for the presence of selectivity bias in each activity, the errors, $\varepsilon_s \quad \forall s \neq M_j$, are normal and independently distributed with median zero and variance σ_s^2. The cross correlation of error among the equations is probable, since all the rural activities in the generation of incomes can be subject to the same stochastic shocks. In order to consider this contemporary correlation among the income sources, the equations of remittances and income are modeled as an equation system using iterated three-stage least squared analysis (Taylor and Yúnez, 2000; Rozelle et al., 1999; Taylor et al., 2003).

C. Data And Empirical Results

1. Data

This research uses new data from the Mexico National Rural Household Survey (Encuesta Nacional a Hogares Rurales de Mexico, ENHRUM). This survey provides detailed data on assets, socio-demographic characteristics, production, income sources, and migration from a nationally representative sample of rural households surveyed in January and February 2003. The sample includes 1,782

households in 14 states. INEGI, Mexico's national information and census office, designed the sampling frame to provide a statistically reliable characterization of Mexico's population living in rural areas, or in communities with fewer than 2,500 inhabitants. For reasons of cost and tractability, individuals in hamlets or dispersed populations with fewer than 500 inhabitants were not included in the survey.[iii] The result is a sample that is representative of more than 80 percent of the population that the Mexican census office considers to be rural.

To implement the survey, Mexico was divided into five regions, reflecting INEGI's standard regionalization of the country: Center, South-Southeast, West-Center, Northwest, and Northeast. The survey was designed to be representative both nationally and regionally. Data from this survey make it possible to quantify migration and remittances at the household level, as well as to test for influences of these variables on household income sources, and on income inequality.

a. Socio-demographic Characteristics of the Rural Mexico

Selected characteristics of households in our samples are summarized in Table 1. Household characteristics include physical capital (land and livestock holdings, and equipment). Landholdings are measured in hectares. Livestock is proxied by the number of large animals (oxen, horses, cows) owned by the household. Equipment is represented by number of tractors owned by the household. Household characteristics also include human capital of family members other than the person surveyed, measured by the household average schooling; migration networks; and an index of family wealth. The wealth index was constructed using the method of principal components with data on household assets, principally housing characteristics (number of rooms; materials used for the construction of floors, walls and roofs; dummy variables indicating whether the house had running water, electricity, and sewerage) and other services and durables (telephone, television, and a refrigerator). The procedure follows closely the one used by McKenzie and Rapoport (2004). Two migration network variables were constructed. On one hand, the number of family members working in the United States and at internal migrant destinations in 1990 is calculated. 1990 was chosen in order to minimize potential endogeneity of migration networks. On the other hand, a dummy variable is constructed to represent whether or not the household head's father had previously migrated to some of the internal or US destinations.

The average size of the household is 5.77 individuals, in a range of 1 to 18 members. The average age and schooling of the household head are 48.6 and 4.5 years, respectively. The average schooling for the rest of the family is 5.45 years. On average, households have 4.8 hectares of land, and 2.8 large animals. Few households own tractors; the average number per household is 0.05. In 1990, households had 0.21 family migrants at internal destinations, and 0.11 migrants in the United States. Only 15 % and 11% of the household heads' fathers had migrated to internal and U.S. destinations, respectively.

At the community level, there are several candidates for indicators of access to markets and access risk. Two were included in this econometric model. The first is frequency of available transport between the village and commercial centers with which villagers transact. In order to construct the frequency of transport variable the following steps were required, (a) create a list of commercial centers (node) with which each village interacts (b) construct an index of frequency of regularly scheduled transportation between the village and each of these nodes, ranging from 0 (less than one trip per day) to 3 (more than six trips per day); and (c) sum this frequency index across commercial nodes. The higher the value of this index, the greater the frequency of transport and number of outside communities with which the village is linked via regularly scheduled transportation. The second is a proxy for security of market access, a dummy variable equal to 1 if the village is accessible in the case of a natural disaster and zero otherwise (e.g., is located at the end of a road or across a bridge that may become inaccessible). The list of community variables also includes the presence of local non farm enterprises, which may offer employment

alternatives to migration. The frequency of transport index averages 8.24 but ranges from 0 to 24. Fourteen percent of villages lack access during weather shocks, and one in four has a non agricultural enterprise.

Table 2 shows the distribution in years of schooling of the sample, suggesting a relatively symmetrical distribution centered in the range from 4 to 6 years. A quantity near 11% represents individuals do not have any schooling. Only 3% have 12 or more years of schooling. More than a third of the sample reported between 4 and 6 years of schooling.

Table 3 presents migration characteristics of rural Mexico by region. For the total sample, 16% of the households had at least one member living in the United States at the beginning of 2002, and 26% of the households had members living in other parts of Mexico. The average number of migrants per household to the United States is 0.35 individuals, while the average of migrants to the interior of the country is 0.71. This makes a total of 1.06 migrants on average per household. The number of migrants to U.S. per household ranged from 0 to 9, while the number of internal migrants ranged from 0 to 10. The graph II displays the tendency of internal migration and migration toward the United States in this sample.

There are sharp differences in migration experience among the five rural regions of Mexico. The West-Center region traditionally has had the highest propensity to send migrants to the United States. It currently has the highest participation rates in international migration and the most international migration experience. Nearly 28% of all households in this region have at least one family member in the United States, and the average household has 0.62 U.S. migrants. By contrast, 7.5% of households in the South-Southwest have U.S. migrants, with an average of 0.10 U.S. migrants per household[iv].

b. Level and Composition of the Net Rural Incomes

Detailed data on household-farm production, wage work, and migration make it possible to estimate total income for each household in the ENHRUM sample. In this paper, net incomes from livestock, agriculture, government transfers, internal and international remittances, wages and net incomes from other sources including commerce, services, and natural resources are calculated. This list of income sources is exhaustive; the sum of income from the seven sources equals household total net income.

There are various methods to estimate net income from rural household production activities. To impute values of family inputs such as labor, land and capital were not used, because it is not obvious what prices should be used to do this. Net income from household production activities was estimated as the gross value of production (using observed local prices) minus purchased inputs. This method yielded net incomes from crop production that were very low or negative in some cases, especially for staples and small animals. Subtracting imputed values of family inputs (e.g., family labor at local wages) from these net income figures would yield mostly negative net staple and livestock incomes.

Incomes from all other household production activities were estimated in a manner analogous to net crop income (as gross value of production minus purchased input costs). Salary and wage income was summed across all household members and jobs. Migrant remittances were summed across all remitters and, in the case of dollar-denominated remittances from the United States, transformed to pesos using the prevailing average 2002 exchange rate of 10 Mexican pesos per U.S. dollar.

Table 5 summarizes rural households' total net income by source. Average household total income for the whole sample in 2002 was 53,465 Mexican pesos ($5,346 USD). This comes out to an average per-capita income of approximately $1,372 USD per year. The composition of incomes reported in the table reveals a significant role of migrant remittances in rural Mexico -13 percent of household total

income (mostly from the United States). Agricultural net income represents more than 12%, and the highest household's income source is wages, which are more than 50% of the total net income.

Summary statistics reveal that migrant remittances potentially have significant impacts on rural income inequality and on rural income sources. It is possible to see some of these economic impacts in the empirical findings.

2. Empirical Findings of Income-Source Gini Decomposition

Table 6 summarizes the contributions of diverse income sources to total income and income inequality in rural Mexico during 2002. The first column, S_k, presents income-source shares. Wages were the largest income source, accounting for 54%. Migrant remittances represented 13% percent of average rural income in 2002. Furthermore, the vast majority of this remittance income (87 percent) came from migrants in the United States. Of this, most (80 percent) was from non-agricultural employment. Government transfers represented just 4%.

The second column of table 5, G_k, presents the Gini coefficient for each income source. Migrant remittances are unequally distributed across rural households. The source Ginis for international and internal remittances are similar: 0.94 and 0.95, respectively.[v]

As indicated earlier, a high source Gini (G_k) does not imply that an income source has an unequalizing effect on total-income inequality. An income source may be unequally distributed and yet favor the poor. This is the case for internal migrant remittances. The Gini correlation between internal remittances and the distribution of total per-capita income (R_k) is only 0.25, comparable to that of public transfers. Because of the low Gini correlation between internal-migrant remittances and total-income rankings, the percentage contribution of internal remittances to inequality (less than 1 percent) is smaller than the percentage contribution to income (1.7 percent). Thus, internal remittances have a slight equalizing effect on the distribution of total rural income. A 10% increase in internal remittances, other things being equal, reduces the Gini coefficient of total income by 0.1 percent.

The Gini correlation between international migrant remittances and total income rankings is much higher (R=0.77). Therefore, international remittances have an unequalizing effect on rural incomes; a 10-percent increase in remittances from migrants abroad increases the Gini coefficient by 0.1 percent.

Government transfers are unequally distributed (G_k = 0.76). However, the Gini correlation between transfers and total income is low (R_k = 0.23), indicating that transfers favor the poor more than any other income source. Other things being equal, a 10 percent increase in government transfers is associated with a 0.3 percent decrease in the Gini coefficient of total income. In rural Mexico, these transfers include decoupled income payments to basic grain producers, under the PROCAMPO program, as well as needs-based transfers under PROGRESA.[vi] Wages are the largest income equalizers in rural Mexico, while income from agricultural activities has the largest positive effect on inequality.

3. Econometric Findings

The results from the estimate of equation (6) using a functional Poisson form are presented in table 7. Two specifications were used to model migration toward the United States and toward the interior of the country. Each specification uses a variable as an instrument to identify the role of the migration networks. The first two columns (columns a and b) present the results using the number of migration contacts in each destination in 1990. The last ones (columns c and d) present the results using the dummy variable of migration networks that involves the households head' fathers migration history.

Like other studies' findings (Rozelle et al., 1999; Taylor et al., 2003), the data show that the household size represents a significant variable that increases the emigration probabilities. It is significant in the four specifications. In all the specifications the variable proxy of migratory networks has the expected sign, although in one case it is not statistically significant. The variable experience and experience squared are significant in all the cases, which suggests that the migrants are young people of productive age.

It is important to note that the variable wealth index (variable proxy to differentiate the level of households' wealth) is positive and significant in both specifications for migration to the United States, while for internal migration it is negative and significant. Moreover, the variable wealth index squared is negative and significant also in all specifications. These results (consistent with other studies, Taylor and Wyatt, 1996; Mckenzie and Rapoport, 2004) suggest that migrants toward the United States come from households that are located at the middle and middle upper levels of income distribution, but they do not come from those households with the highest revenues, due to their higher opportunity cost of assignment members to migration . On the other hand, internal migrants come from the middle and middle bottom of the income distribution. Predictions from both equations are highly correlated with the actual number of migrants; they range from 0.43 to 0.61.

The predictions from the migration equation can be interpreted as the expected or predicted number of migrants for each household and are incorporated in the income sources equations. In order to estimate the impacts of migration and remittances on different income sources, the predicted number of migrants obtained from the estimation of equation (6) -columns (a) and (b)-of was incorporated into the income equations.

The results of the system of equations are presented in table 8. The estimates from the equation of international remittances suggest that the variables that determine this income source are household size, predicted number of migrants (possible to see that when making one more member available for migration, the remittances increase by $7,673 pesos) and the community norm for sending remittances (e.g. if the average remittances sent to the community increases by one peso, the incomes from international and internal remittances will increase 90 cents and 66 cents, respectively). In this way, it is expected that households which send out migrants can expect that migrants, on average, will contribute to the rural household income.

Another important result is that national remittances and the predicted number of international migrants impact in a positive way the incomes obtained from livestock activities, although international remittances impact negatively on this income source. It is also pertinent to note the negative impact of the predicted number of internal migrants on wage income. International remittances have the same negative impact on this income source. These findings suggest that when a household loses one of its members, it presents a decrease in its capacity to capture resources from this source, because it has less labor resources to assign to this activity.

In general terms, the results support the NELM hypothesis that points out that the remittances eliminate restrictions in different types of rural households' productive activities. Although the interpretations above are largely deductive, based on the results it is possible to assert that, at least in the case of livestock, migration and remittances have complex effects on household income in rural Mexico. Moreover, taken as a whole, the main results should caution researchers and policy analysts from drawing implications from work that does not account for such complexities.

D. CONCLUSIONS

This work has endeavored to determine the relationships between migration, remittances and the different income sources of Mexican rural households. First of all, decomposing the households' net income into its different sources is possible note that international remittances have a negative impact in the income distribution. That the individuals who migrate do not come from the poorest households, because international migration has a higher risk and cost, may explain this impact. This assertion is backed up with the econometric results from the equation used to model migration. There it is possible to see that the wealth index variable has a positive and significant effect. Meanwhile, the same variable squared has a negative and significant effect, suggesting an inverted-U relationship between migrants and their level of wealth. In other words, households who allocate international migrants are within the middle and middle upper income of the income distribution spectrum.

The national remittances impact is a decrease in the Mexican rural households' inequality level. The lesser risks and costs of internal migration explain this effect. Hence, a higher number of households can engage in this activity, without regard to which part of the income distribution they belong. Furthermore, as the results from the migration function suggest, these households are the less wealthy, causing a decrease in the distribution gap.

The econometric results indicate that the principal migration motivators, as the literature predicts, are the household size and the existence of migratory networks. In this manner, the remittances effects on the different income sources are not null. Migratory phenomena represent cost for households that allocate members to migration in the form of loss of work force, and reflected in the decrease of wages income. It also promotes other income sources such as the livestock and the agricultural sector. Additionally it influences directly the rural households' income capture. Establishing the net impact is among the future objectives of the present investigation.

The results found support the hypothesis presented by the NELM -that the remittances decrease the restrictions over the production decisions in an environment of imperfect markets. These results provide evidence of the financial intermediary role that migrants play by sending remittances to their households and their origin communities.

The effects generated by migration and remittances on rural households surely are more complex that those covered by this paper. But using the ENHRUM data set, there is evidence to establish that households invest part of their income generated from remittances in productive activities. Furthermore, these incomes generated from remittances influence the income inequality of the source communities.

TABLES AND FIGURE

Table 1. Descriptive Statistics, ENHRUM

Variable	*Mean*	*Std. Dev.*	*Mín.*	*Max.*
Household Size	5.77	3.02	1	18
Number of children	0.54	0.89	0	8
Age of household head	48.62	16.11	15	95
Schooling of household head	4.47	3.74	0	20
Average of household's schooling	5.45	2.48	0	16.6
Number of Family Members at Internal Migrant Destination in 1990	0.21	0.56	0	5
Number of Family Members at U.S. Migrant Destination in 1990	0.11	0.4	0	5
Household head's father internal migrant (Dummy)	0.15	0.36	0	1
Household head's father U.S. migrant (Dummy)	0.11	0.32	0	1
Landholdings	4.8	25.08	0	537.5
Livestock (number of large animals in 2001)	2.76	13.56	0	252
Tractors Owned by Household in 2001	0.05	0.22	0	2
Wealth Index	0	2.03	-6.2816	4.4829
Frequency of Transport	8.24	5.91	0	24
Inaccessibility During Weather Shocks (Dummy)	0.14	0.34	0	1
Nonagricultural Enterprise in Village (Dummy)	0.26	0.44	0	1
Average of community internal remittances	895.42	1120.62	0	4036.4
Average of community U.S. remittances	5885.77	9166.38	0	49208

Source: ENHRUM, 2003. Simple Size = 1,782 Households.

Table 2. Schooling Attainment, by level

Years of Completed Schooling	*Count*	*Percentage*
0	798	10.93%
1-3	1218	16.69%
4-6	2610	35.76%
6-9	1866	25.57%
10-12	573	7.85%
>12	233	3.19%
Total individuals	7,298	100.00%

Source: ENHRUM, 2003.

Table 3. Migration Summary Statistics for Rural Mexico, by Region

Region	*Variable*	*Percentages*	*Mean*	*SD*	*Min*	*Max*
South-South East	Households with US migrants (%)	7.53%	-	0.26	-	-
	US Migrants per Household		0.1	0.42	0	3
	Households with Internal migrants (%)	34.95%	-	0.48	-	-
	Internal Migrants per Household		0.89	1.61	0	8
	Household Sample Size		372			
Center	Households with US migrants (%)	14.52%	-	0.35	-	-
	US Migrants per Household		0.27	0.89	0	8
	Households with Internal migrants (%)	29.32%	-	0.46	-	-
	Internal Migrants per Household		0.7	1.48	0	8
	Household Sample Size		365			
Center-West	Households with US migrants (%)	27.75%	-	0.45	-	-
	US Migrants per Household		0.62	1.29	0	7
	Households with Internal migrants (%)	30.06%	-	0.46	-	-
	Internal Migrants per Household		1.02	1.99	0	10
	Household Sample Size		346			
Northwest	Households with US migrants (%)	12.09%	-	0.33	-	-
	US Migrants per Household		0.23	0.79	0	9
	Households with Internal migrants (%)	22.42%	-	0.42	-	-
	Internal Migrants per Household		0.72	1.71	0	8
	Household Sample Size		339			
Northeast	Households with US migrants (%)	19.72%	-	0.4	-	-
	US Migrants per Household		0.54	1.43	0	9
	Households with Internal migrants (%)	11.67%	-	0.32	-	-
	Internal Migrants per Household		0.23	0.8	0	8
	Household Sample Size		360			
Total	Households with US migrants (%)	16.22%	-	0.37	-	-
	US Migrants per Household		0.35	1.04	0	9
	Households with Internal migrants (%)	25.76%	-	0.44	-	-
	Internal Migrants per Household		0.71	1.58	0	10
	Household Sample Size		1782			

Source: ENHRUM, 2003

Table 4. Descriptive Statistics for Households which Receive Internal and U.S. Remittances and for Households that do not

Variable	*Households with U.S. Remittances*	*Households with Internal Remittances*	*Household without remittances*
	(n=295)	(n=236)	(n=1294)
Number of U.S. Migrants	1.58	0.34	0.11
	(1.79)	(1.00)	(0.58)
Number of Internal Migrants	0.89	2.56	0.39
	(1.64)	(2.33)	(1.19)
U.S. Remittances	35570.03	9104.58	---
	(65411.08)	(47198.44)	
Internal Remittances	1178.27	6778.51	---
	(4999.76)	(9839.38)	
Livestock Income	2956.58	756.24	1952.39
	(25856.93)	(16598.48)	(15677.89)
Agricultural Income	6504.93	4105.86	7229.53
	(32990.73)	(29467.17)	(76914.71)
Government Transfers	3132.39	2542.31	2122.66
	(5454.45)	(3523.89)	(4813.93)
Wages	16529.87	23879.99	32553.16
	(36296.68)	(51511.36)	(52197.69)
Other Incomes	6670.72	4784.98	7167.38
	(19616.49)	(12484.67)	(27304.68)
Net Total Income	72542.78	51952.47	51025.11
	(90480.63)	(81635.98)	(103039.20)
Schooling of Household Head	3.70	3.09	4.84
	(3.33)	(2.92)	(3.86)
Age of Household Head	53.27	59.20	46.09
	(15.17)	(14.95)	(15.60)
Household Size	7.35	7.74	5.16
	(3.05)	(2.87)	(2.81)
Number of Children	0.46	0.41	0.58
	(0.82)	(0.85)	(0.90)
Average of Household's Schooling	5.55	5.06	5.50
	(2.08)	(2.55)	(2.54)
Landholdings	7.12	4.77	4.40
	(31.69)	(11.39)	(25.10)
Livestock	5.57	2.60	2.24
	(23.12)	(8.89)	(11.11)
Tractors	0.13	0.03	0.03
	(0.34)	(0.17)	(0.18)
Wealth Index	0.98	-0.47	-0.12
	(1.65)	(2.03)	(2.05)

Source: ENHRUM, 2003. Standard errors in parentheses

Table 5. Composition of Net Income, by Source

Variable	*Mean*	*Participation*
Livestock Income	1983.38	3.71%
Agricultural Income	6627.15	12.40%
Government Transfers	2326.39	4.35%
Internal Remittances	897.71	1.68%
U.S. Remittances	5888.42	11.01%
Wages	28949.05	54.15%
Other Incomes	6793.2	12.71%
Total	53465.31	100.00%

Source: ENHRUM, 2003.

Table 6. Gini Decomposition by Income Source

Income Source	*Share in Total Income (S_k)*	*Gini Coefficient for Income Source (G_k)*	*Gini Correlation with Total Income Rankings (Rk)*	*Contribution to Gini Coefficient of Total Income* ($S_kG_kR_k$)	*Percent Share in Gini of Total Income*	*Effect of a 10% Increase on Total Income Gini Percent Change*
Livestock	0.04	1.70	0.55	0.04	0.06	0.22%
Agricultural	0.12	1.13	0.77	0.11	0.18	0.57%
Government Transfers	0.04	0.76	0.23	0.01	0.01	-0.31%
Internal Remittances	0.02	0.95	0.25	0.00	0.01	-0.10%
US Remittances	0.11	0.94	0.69	0.07	0.12	0.10%
Wages	0.54	0.69	0.81	0.30	0.51	-0.36%
Others	0.13	0.86	0.63	0.07	0.12	-0.12%
Total Income	1.00	0.60	1.00	0.60	1.00	

Table 7. Impacts of Household Characteristics and Migration Networks on Migration

Independent Variable	*Specification*			
	FAMUS (1990)	*FAMEX (1990)*	*HHFUS*	*HHFMEX*
	(a)	*(b)*	*(c)*	*(d)*
Household Size	0.18503	0.20662	0.18621	0.20738
	(13.93)***	(23.94)***	(14.38)***	(24.23)***
Schooling of household head	-0.01736	0.0208	-0.01934	0.02127
	(-1.10)	(1.77)*	(-1.21)	(1.82)*
Household Head Experience	0.14282	0.11716	0.14904	0.11824
	(7.95)***	(9.99)***	(8.32)***	(10.06)***
Experience Squared	-0.00136	-0.00075	-0.00134	-0.00075
	(-7.75)***	(-7.75)***	(-7.81)***	(-7.23)***
Wealth Index	0.28259	-0.05813	0.31706	-0.06651
	(9.14)***	(-3.30)***	(10.40)***	(-3.80)***
Index Squared	-0.03333	-0.02383	-0.02724	-0.02409
	(-2.60)***	(-3.31)***	(-2.13)**	(-3.35)***
Landholdings	-0.00247	-0.00005	-0.00337	-0.00001
	(-1.40)	(-0.03)	(-2.02)**	0
Livestock	0.00727	-0.00722	0.00804	-0.00674
	(3.55)***	(-2.11)**	(4.00)***	(-2.04)**
Tractors	0.27596	0.18164	0.28958	0.15411
	(2.24)**	-1.57	(2.38)**	-1.33
Frequency of Transport	-0.01002	0.01928	-0.00468	0.02187
	(-1.28)	(3.81)***	(-0.60)	(4.36)***
Inaccessibility During Weather Shocks (Dummy)	0.29443	-0.01894	0.20035	0.00905
	(2.31)**	(-0.22)	-1.59	-0.1
Nonagricultural Enterprise in Village (Dummy)	-0.10617	0.10489	-0.15302	0.07698
	(-1.08)	-1.58	(-1.56)	-1.17
Number of Households Migrants in 1990	0.53729	0.16103	---	---
	(12.53)***	(4.56)***		
Household head's father migrant (Dummy)	---	---	0.4073	0.01972
			(3.56)***	-0.23
Regretion statistics				
Log – likelihood	-1163.2468	-1683.674	-1213.8925	-1693.135
Predicted migrants, minimum	0.0018	0.0057	0.0015	0.006
Predicted migrants, maximum	10.325	13.1304	7.1983	14.3854

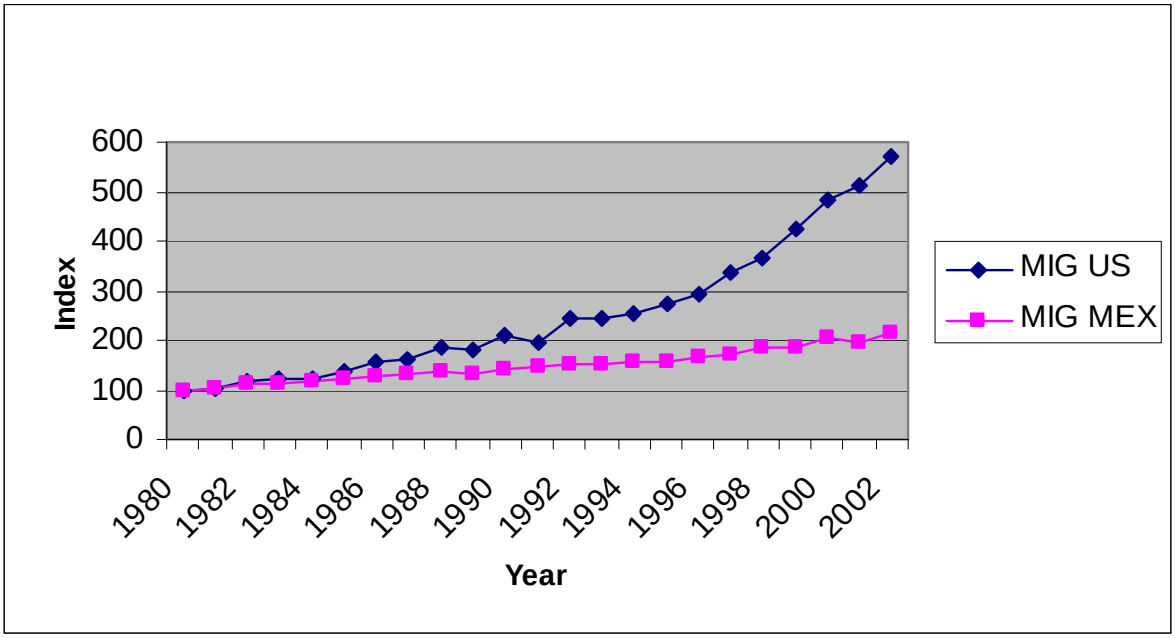
NOTE: t-statistics are in parentheses.* Significant at 10%; **significant at 5%; ***significant at 1%

Table 8. Impacts of Migration and Remittances on Income Sources

Independent Variable	*Remittances*		*Livestock*	*Agricultural Income*	*Government Transfers*	*Wage Income*	*Other Income*
	International	*Internal*					
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Number of International Migrants, Predicted	7673.133	---	2526.403	9345.644	-86.15833	-35.6147	1666.384
	(5.81)***		(2.87)***	(2.52)**	(-0.31)	(-0.01)	-1.16
Number of Internal Migrants, Predicted	---	236.8437	-59.29351	-1532.092	-75.59257	-4830.245	-2337.949
		-1.51	(-0.10)	(-0.61)	(-0.41)	(-2.51)**	(-2.38)**
International Remittances	---	---	-0.2419845	-0.1118332	0.0487349	-0.3283141	0.0429826
			(-5.17)***	(-0.57)	(3.26)***	(-2.19)**	-0.58
Internal Remittances	---	---	0.7303237	1.416861	0.1631393	0.9254694	0.2551835
			(2.27)**	-1.01	-1.6	-0.87	-0.47
Household Size	716.7497	75.50249	-93.53009	-438.3165	1.507255	3806.431	709.5458
	(2.53)**	-1.42	(-0.42)	(-0.48)	-0.02	(5.52)***	(2.02)**
Schooling of household head	-145.7124	-17.66344	21.45785	31.90633	35.08078	-44.47116	505.4219
	(-0.54)	(-0.44)	-0.16	-0.06	-0.85	(-0.09)	(2.05)**
Average of household's schooling	80.9482	91.11767	---	---	---	5395.258	1119.209
	-0.26	(1.87)*				(8.87)***	(3.63)***
Household Head Experience	-206.2542	-20.38705	25.35776	-1084.251	66.29348	-307.1483	113.4802
	(-1.20)	(-0.78)	-0.25	(-2.41)**	(2.00)**	(-0.97)	-0.7
Experience Squared	1.60471	0.4060305	-0.4084213	10.08222	-0.6880313	4.126798	-0.3865661
	-0.86	-1.36	(-0.35)	-2	(-1.83)	-1.14	(-0.21)
Landholdings	-19.25072	-0.8503073	66.95823	193.1753	3.529821	-38.78523	---
	(-0.73)	(-0.22)	(4.23)***	(2.86)***	-0.71	(-0.77)	
Livestock	---	---	616.7025	-3.405236	70.54874	-177.5018	---
			(19.06)***	(-0.03)	(7.23)***	(-1.84)*	
Tractors	---	---	---	73865.46	---	---	---
				(10.13)*			
Frequency of Transport	-6.452589	-7.33612	-81.10066	-117.926	59.00358	-647.4173	80.90188
	(-0.06)	(-0.44)	(-1.27)	(-0.45)	(2.95)***	(-3.23)***	-0.79
Inaccessibility During Weather Shocks (Dummy)	-367.1046	-18.07048	-1529.31	-1827.826	115.7246	-10002.27	1354.824
	(-0.19)	(-0.06)	(-1.40)	(-0.41)	-0.34	(-2.94)***	-0.78
Average of community international remittances	0.8787855	---	---	---	---	---	---
	(11.83)***						
Average of community internal remittances	---	0.9612883	---	---	---	---	---
		(10.94)***					
Inverse Mills ratio	---	---	-2577.322	-15770.56	-1737.296	---	---
			(-1.84)*	(-3.12)***	(-3.05)***		

NOTE: t-statistics are in parentheses. * Significant at 10%; **significant at 5%; *** significant at 1%

Figure 1. Trends in Internal and International Migration, 1980-2002



ENDNOTES

[i] This money is quantified only in formal mechanisms of reception, for example banks.
[ii] In the study international migration is defined as migration mainly to the United States, as well as internal migration.
[iii] The percentage of the population of Mexico that lives in hamlets of less than 500 people is no more than 20% in 2000, INEGI, population Census 2000.
[iv] For descriptive statistics of households which receive internal and international remittances and those that do not see table 4
[v] These source Ginis are high in part because they include zero remittances for some households.
[vi] PROCAMPO was instituted in the context of a phase-out of price guarantees to basic grain producers. It represented a shift from price based support measures to direct income payments. PROGRESA provides payments to poor rural households, linked to enrollment of children in schools and local clinics.

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