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# Family and Community Networks in Mexico-U.S. Migration

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**Abstract**

A household's decision to send migrants is based on information the household has on the expected returns and the costs of migration. Information on migration flows from both family migrant networks and community migrant networks. Direct assistance – in the form of money, housing, transportation, and food – is often provided to migrants by these networks, thus reducing the costs of migration. Using data from a national survey of rural Mexican households, we show the importance of networks in both the decision to migrate and the level of migration. We find that community and family networks are substitutes in the production of information and assistance suggesting that, once migration is well established in a community, family networks become less important. In addition, the development of strong community networks erases the role of household characteristics in migration, allowing those initially least favored to also participate in migration. Results suggest that policies designed to reduce Mexico-U.S. migration should focus on regions where migrant networks are yet weakly developed since, once strong community networks become established, reducing migration would require much higher levels of public investment.

Key Words: Migration, networks, Mexico

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**Family and Community Networks in Mexico-U.S. Migration**

## 1. Determinants of migration

Neo-classical models explain the decision to migrate as the outcome of a cost-benefit calculation where potential migrants compare the expected income at the destination to income at the point of origin (Sjaastad, 1962; Todaro, 1969, 1976; Todaro and Maruszko, 1987). The "new economics of migration" has added explanatory power to the neo-classical model by focusing on a household's decision to send migrants in a context where migration serves to mitigate the impact of insurance and credit market failures on emitting households (Stark and Bloom, 1985). A complementary line of research on the determinants of migration has focused on the importance of migrant networks in the migration decision.[1] Some have argued that the network theory of international migration "provides a framework for understanding the relative importance of non-economic versus economic factors" (Waldorf, 1996). However, if networks serve as a means of conveying information from those with migration experience to potential migrants, and network members assist new migrants, then networks serve to influence the expected income gains from, and the uncertainty associated with, migration.[2] Networks may then serve an important economic function that influences the decision to migrate. In this paper, we examine the role of family and community-based migration networks in Mexico-U.S. migration from this perspective, using data from a national survey of rural Mexican households from the ejido sector. [3]

Recent quantitative evidence supports the important role that migrant networks play in explaining Mexico-U.S. migration. Massey and Garcia España (1987) observe that the probability of migration to the United States is higher for households with prior migration experience and for households living in communities with extensive migration. Taylor (1986) focuses on the differential role of international and internal networks, arguing that if networks serve to reduce the riskiness of returns to migration (by providing better information), then networks should be more important in assisting more risky international migration than in less risky internal migration. Econometric results support this hypothesis. Additional studies suggest that networks not only increase the probability of migration, but positively influence the economic returns to migration through higher wages and greater number of hours worked (Neuman and Massey, 1994; Massey, 1987; and Donato, Durand, and Massey, 1992). Roberts and Morris (1996) explore the relationship between remittances and networks. They argue that remittances serve as a payment for membership in a migrant network which provides information to members that enhance economic mobility. Econometric results show a positive relationship between migrant networks and remittance levels. Studies on migration in India (Banerjee, 1991), Germany (Bauer and Zimmerman, 1997) and the Phillipines (Caces, 1986; Findley, 1987) note the importance of networks in rural-urban migration in those countries.

The networks literature suggests two mechanisms by which migrant networks affect migration (e.g., Boyd, 1989; Gurak and Caces, 1992). First, members of the network may provide direct assistance to migrants (e.g., housing, food, transportation, etc.) that reduces the cost of migration. Second, the network provides information, which allows recipients to update their subjective distribution of returns from migration. For example, Menjivar (1995), based on interviews with Mexican immigrants in California, notes that it is not uncommon for newly arrived migrants to stay with kin, borrow money from them, and seek their assistance in emergencies. "Kin terms" were also extended to members of their hometown. Additionally, Menjivar notes that the majority of interviewees mentioned a friend or relative "who took them to,

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[1] This line of research has been less prominent in economics than in other social sciences (e.g., Boyd, 1989; Massey et al., 1993). Some notable exceptions are Taylor (1986) and Chau (1997).

[2] The household-specific returns to migration depend on the costs the household must pay to migrate and the knowledge the household has of the returns to migration. Knowledge can be defined as an accumulated body of data or evidence about the world. Information on migration, which comes as a message or news, can be denoted as an increment (flow) to this stock of knowledge (Hirshleifer and Riley, 1992). The knowledge a potential migrant has about migration determines his/her subjective distribution of the returns to migration.

[3] The ejido sector was created by the land reform following the revolution of 1910. It is composed of villages with surrounding farm lands which are partly in individual usufruct and partly common access. This sector includes half of the Mexican territory and some 60 to 65% of rural households. It is a major source of migrants to the United States (see de Janvry, Gordillo, and Sadoulet, 1997).

recommended them for, or informed them about a job." Theoretically, certain types of information may lead to a less favorable perception of migration (e.g., information on a crackdown by the immigration service), but over the long run information on migration to the United States from Mexico is likely to improve the subjective distribution of returns. Whether direct assistance or information is the more important component of network assistance is not addressed in this paper. Instead, we hypothesize that networks reduce the cost of migration and improve the anticipated return from migration.

In this paper, we distinguish the role of family and community networks. Family networks can be viewed as similar to those discussed in the sociology literature as "strong ties" networks and community networks are similar to "weak ties" networks – the former being between close friends and kin and the latter involving relationships between acquaintances (Boyd, 1989; Grieco, 1998; Wilson, 1998). Both networks are expected to provide varying degrees of assistance and information to potential migrants. Banerjee (1984), similarly distinguishes between direct and latent information. Direct information is that which has been transmitted through visits or contacts with relatives in an urban center while latent information is the common knowledge about migration that has come from community gatherings and observations of other migrant households. Along similar lines, we distinguish between family and community networks information. Family network information only benefits the immediate family and is directly transmitted to the household from the previous or current migration experiences of extended family members. Community network information, which benefits the entire community, results from the relayed migratory experiences of members of the community – the folk-wisdom about migration. Community network information is from the same migrants who have provided information to family members. Community network information is then information that has filtered into the community. The value of this information, relative to information directly received from the family, depends on two factors. First, it depends on whether a privately received message is fully expressed. In some cases, such as the relay of information on a specific job opening in the United States, the information will not be shared with other members of the community if sharing creates competition for family members. For more general information, while there may be no reason to withhold information, particularly in small, cohesive ejido communities, the retelling of messages may not be complete. Second, the source of a message is important. If a potential migrant receives a message second- or third-hand without information on the source, or with limited information on the source, then the value placed on that message would be lower. Recognizing the importance of community networks on migration, in creating a "pre-migration information" variable, Banerjee includes information obtained from relatives or covillagers in the city. She observes that 90% of those who reported having relatives or covillagers in an urban center migrated to that particular city. Caces (1986) and Findley (1987) note a similar migration pattern in the Philippines as do a number of analysts of Mexico-U.S. migration (Durand and Massey, 1992).

The benefits of networks for a potential migrant depend on how that network may be used. If family and community networks are useful for similar purposes, then one is a substitute for the other. For example, they are substitutes if they are both useful in job search. In this case, community network information may be thought of as the fraction of family network information that has become public knowledge. If, however, family and community networks serve different functions, then they may be viewed as complements. For example, a community network may assist in circumventing the border while family network helps in job search. In this case, the value of a family (community) network is greater the more a community (family) network is available. After developing these propositions formally, we use econometrics to test whether family and community networks are substitutes or complements.

In this analysis, we assume that information on migration comes solely from migrant networks. In principle, such information could come from sources other than migrant networks. In particular, the media may play an important role in providing migration information. This is more likely to be the case in developed economies where information on employment opportunities in other regions and on the cost of migration is easily accessible through newspapers, television, and the internet. In international migration from developing to developed economies, particularly rural areas where access to the media is limited, the role of the media is less important and whatever role it has plays relatively uniformly across communities. Data comparing the destinations of domestic and international migrants in the United States support this argument. Frey (1996) shows that international migrants to the U.S. and relocating migrants within the U.S. differ sharply in their chosen settlement areas: international migrants tend to cluster in traditional immigrant destinations where ethnic ties are well established, while domestic migrants, who are less dependent on such ties, are more "economically rational" in their relocation decisions. In migration from the ejido sector to the United States, which is the focus in this paper, the media, in this case principally radio broadcasts, is likely to provide general information on the state of the U.S. economy or on current border activities. However, relative to migrant networks, the media is not expected to play an important role in providing information to potential migrants from the ejido sector and the role that it does play is not expected to vary greatly across ejidos.

Research on Mexico-U.S. migration has generally relied upon data representing a specific geographical area of Mexico, such as a few villages or a particular state or region. Although limited geographically, the results of these studies have often been generalized to Mexico-U.S. migration as a whole. In noting this phenomenon, Durand and Massey (1992) argue that this practice has led to contradictory conclusions regarding migration. They argue that these contradictions stem from differences in community characteristics, including the presence or absence of networks. To avoid this problem, they suggest including community variables in the analysis of migration. Analyses that only include community migrant networks run the risk of spurious correlation between network variables and migration. That is, community networks may be found to significantly influence migration not because they serve a function in the migration decision, but because they represent common unobservable community characteristics such as community development or organization. To control for the influence of community characteristics in the migration decision, and avoid the problem of spurious correlation, we include regional (municipality) and ejido (village) variables in our analysis along with household and migrant network variables.

Current ejido sector reforms in Mexico have the potential of altering migration patterns. Policy prescriptions suggested by research on migration often focus on the need for rural development to stem the flow of migrants to urban centers and foreign countries (see for example Diáz-Briquets and Weintraub, 1991). Policies that increase expected income, lower income uncertainty, and reduce credit and insurance market failures in emitting areas have been suggested as means to reduce migration. However, the return to investment in rural development, measured in terms of reduced migration, depends on the accumulation of migration capital in a particular location. Our results suggest that once community networks are strongly established, infrastructure development (captured by paved roads in our analysis) no longer refrains the migration movement. This is admittedly a very partial result that would require further investigation, but it is nonetheless suggestive and consistent with the theory of cumulative causation of migration.

This paper is divided into six sections. Section 2 develops a model of a rural household migration decision that stresses the role of migrant networks. The data are discussed in detail in section 3 and empirical specification of the model is developed in section 4. Results presented in section 5 confirm that migrant networks play an important role in migration decisions. In section 6, the role of community networks is analyzed further by contrasting the determinants of migration among households with access to weak and strong networks. Results show that once migration is well developed in a community, all households partake in migration, regardless of their characteristics. Section 7 shows that migrants tend to go to the same location as network migrants, confirming the role of networks in migration decisions. Conclusions and policy implications are discussed in section 8.

## 2. A model of migration

The purpose of this section is to develop a model that highlights the role of migrant networks in the household labor allocation decision. The model stresses the impact on migration decisions of information and direct assistance provided by family and community networks. The migration decision is modeled from a household perspective such that migration is part of the household's overall income generating and risk management strategy. This is compelling in these circumstances because of the link to the farm economy of non-migrating household members.

### *2.1. A household model*

Consider a single rural household that receives income from labor and is endowed with a fixed amount of labor $L$. The household allocates $l$ units of labor to migration and $(L - l)$ units to agricultural production. Agriculture can be specified as having a risky return $A$ decomposed additively as:

$$A = a + m,$$

where $a$ is the expected return to agricultural production and $m \sim N\left(0, s_m^2\right)$ represents a random component.

The return to migration depends on the stock of migration information that is available to the household. The production of migration information is a function of the size of the family migrant network, $n \geq 0$, as well as the size of the community migrant network, $N \geq 0$. The size of the migrant networks is a measure of the total migration experience of family members ($n$) and of community members ($N$). The specification of the return to migration, $M(n,N)$, follows a form similar to that proposed by Just and Pope

(1978) in which the expected return and the variance of the random component of return depend on the size of networks:

$$M(n,N) = m(n,N)w + \sqrt{v(n,N)}\varepsilon,$$

where $w$ is the expected value of migration in the absence of networks, $\varepsilon \sim N(0, \sigma_\varepsilon^2)$ is a random component, and the functions $m(n,N)$ and $v(n,N)$ represent the influence of migrant networks on the expected value and variance of returns to migration. By normalization, we assume that $m(0,0) = v(0,0) = 1$. As the size of each network grows, the expected return to migration increases since information is deemed to positively influence returns to migration and $\frac{\partial m}{\partial n} = m_n(n,N) > 0$, $\frac{\partial m}{\partial N} = m_N(n,N) > 0$.[4] Assuming that information on migration lowers the variance of returns to migration, then $\frac{\partial v}{\partial n} = v_n(n,N) < 0$ and $\frac{\partial v}{\partial N} = v_N(n,N) < 0$. The parameters of the functions $m(n,N)$ and $v(n,N)$ depend on the importance of each individual network and the relative importance of each network in the production of information.

Migration, particularly across international borders, has an entry cost. This cost is only paid if a household member migrates. It consists, for example, of information costs, payment to intermediaries to cross the border, and direct survival costs upon arrival. This cost is only incurred by the first member of the family, who then can directly assist the other members, and may be lower for households with access to networks since networks provide direct assistance. The entry cost into migration, $C(n,N) > 0$, is then a function of the network characteristics $n$ and $N$ and is assumed to decrease with respect to network size, $\frac{\partial C}{\partial n} = C_n(n,N) < 0$ and $\frac{\partial C}{\partial N} = C_N(n,N) < 0$.[5]

Given these assumptions, household income is defined as:

$$Y = (L - l)A + lM(n,N) - C(n,N)1(l > 0),$$

where $1(l > 0)$ is an indicator equal to 1 when $l > 0$ and 0 otherwise. Thus, the costs of migration are only incurred when there is at least one migrant from the household.

Consider a risk averse household with a mean-variance utility function $U(Y) = EY - \phi \operatorname{var} Y$. The household's decision problem may thus be represented as:

$$\max_l U(Y) = EY - \phi \operatorname{var} Y,$$

s.t.: $$EY = (L - l)a + lm(n,N)w - C(n,N)1(l > 0),$$

$$\operatorname{var} Y = (L - l)^2 \sigma_m^2 + l^2 v \sigma_e^2,$$

$$0 \le l \le L.$$

[4] It is possible that information might negatively effect the return to migration. Information on an economic downturn or a strengthening of border security may lower expected returns (although it may also lower the variance of returns). In net, information is assumed to positively affect the distribution of returns to migration.

[5] The specification of an entry cost is similar to that of Chau (1997) who models the costs of migration as a function of "migration propensity" and network size. She also assumes that costs are decreasing with network size. The concept of a fixed entry cost at the household level is meant to represent the huge differential cost and informational advantage that households with already one migrant have over those who are trying to send their first migrant. Since this difference is not reflected in the family network variable (as the members of the household cannot be counted in the family network when the unit of analysis is the household), we capture it as an entry cost for the first migrant.

Given the entry cost of migration, the household must compare expected utility without migration ($l = 0$) to expected utility under the optimal level of migration ($l^*$) derived from the first order condition of the household's decision problem. The Kuhn-Tucker conditions for the problem give:

$$l^{**} = \frac{m(n,N)w - a + 2\phi L\sigma_m^2}{2\phi\left(\sigma_m^2 + v(n,N)\sigma_e^2\right)} \quad \text{and} \quad l^* = \begin{cases} 0 & \text{if } l^{**} \le 0, \\ l^{**} & \text{if } 0 < l^{**} \le L, \\ L & \text{if } l^{**} > L. \end{cases} \tag{1}$$

Equation (1) provides the optimal allocation of labor, $l^*$, if the household is justified in paying the entry cost. Mathematically, the household is justified in paying entry costs when the expected utility under labor allocation $l^*$ and entry cost $C(n, N)$ is greater than the expected utility when no labor is allocated to migration and entry cost is zero:

$$U\left[\left(L - l^*\right)A + l^* M(n,N) - C(n,N)\right] \ge U[LA],$$

or $$-\phi l^{*2}\left(\sigma_m^2 + v(n,N)\sigma_e^2\right) + l^*\left(m(n,N)w - a + 2\phi L\sigma_m^2\right) - C(n,N) \ge 0,$$

or $$C(n,N) \le C_{\max} = \begin{cases} \frac{1}{2} l^*\left(m(n,N)w - a + 2\phi L\sigma_m^2\right) & \text{if } l^* < L, \\ L\left(m(n,N)w - a + \phi L\left(\sigma_m^2 - v(n,N)\sigma_e^2\right)\right) & \text{if } l^* = L, \end{cases} \tag{2}$$

where $C_{\max}$ is defined as the maximum affordable entry cost. If entry cost $C(n, N)$ is higher than the right-hand side of equation (2), then the household will send no migrant. For a lower cost, the optimal number of migrants is $l^*$ given in (1). Note that if expected return from migration is higher than in residence ($mw \ge a$), satisfaction of (2) implies that $l^* > 0$. Hence, the entry cost remains the only potential binding constraint on the decision to participate in migration.

Equations (1) and (2) explicitly describe the migration decision as one where there is a trade-off between the returns to agricultural production and to migration. For a very low expected return to migration and/or a relatively high risk to migration, the household will not send any migrants, while for a very high expected return and/or relatively low risk to migration, the household will send all its family members. The interior solution exhibits the usual trade-off between the expected return and riskiness of the two options. When there are no networks, $m(0,0) = 1$ and $v(0,0) = 1$, then the solution corresponds to the standard portfolio case (Stark and Levhari, 1982). The addition of network variables explicitly adds the importance of information and cost-reducing assistance in this trade-off.

*2.2. Comparative statics*

In this section, we examine how individual parameters influence the migration decision. To do this, we derive comparative static results for both the level of migration (equation 1) and the entry costs (equation 2). Note that a parameter that increases $C_{\max}$ increases the likelihood of migration. To derive comparative static results, we assume that the expected return to migration is higher than the return to agricultural production, $m(n,N)w > a$, for all $n$ and $N$. We also assume that the variance of returns to migration is higher than the variance of returns to agriculture, $\sigma_m^2 < v(n,N)\sigma_e^2$, $\forall n,N$. These assumptions are reasonable considering that our focus is migration from Mexico to the United States and expected income and risk are likely to be higher in the United States than in Mexico.

Derivation of (1) and (2) gives:

$$\frac{\partial l^*}{\partial L} \ge 0,\ \frac{\partial l^*}{\partial a} \le 0,\ \frac{\partial l^*}{\partial \sigma_m^2} \ge 0,\ \frac{\partial l^*}{\partial w} \ge 0,\ \text{and}\ \frac{\partial l^*}{\partial \sigma_e^2} \le 0,$$

$$\frac{\partial C_{\max}}{\partial L} > 0,\ \frac{\partial C_{\max}}{\partial a} < 0, \frac{\partial C_{\max}}{\partial \sigma_m^2} > 0,\ \frac{\partial C_{\max}}{\partial w} > 0,\ \frac{\partial C_{\max}}{\partial \sigma_e^2} < 0. \tag{3}$$

All parameters influence the maximum affordable entry cost $C_{\max}$ and the level of migration $l^*$ in the same direction. As the household labor endowment, $L$, increases so does migration. Since risk averse households desire to maintain a portfolio of labor activities, an increase in the labor endowment exerts pressure towards increasing the level of migration for migrant households and increases the desirability of migration for non-migrant households. Not surprisingly, migration decreases with the expected return to agriculture, $a$, and increases with the variance of returns to agriculture, $\sigma_m^2$, since the former makes migration a less appealing option relative to agriculture and the latter makes it more appealing. Recall that the variables $w$ and $\sigma_e^2$ should be interpreted respectively as the expected return and the variance of returns to migration when there are no networks. Migration increases with the expected return to migration, $w$, and decreases with the variance of returns to migration, $\sigma_e^2$, as expected since a higher return to migration makes migration more appealing and an increase in the uncertainty of migration makes migration less appealing for a given level of risk aversion.

*Family and community networks* ($n$, $N$): Looking at the role of networks on the migration decision, derivation of (1) and (2) show that if migrant networks increase the expected return to migration and lower the variance, then the larger the migrant network (family and community) the higher the level of migration and the higher the maximum affordable entry cost:

$$\frac{\partial l^*}{\partial n} \geq 0, \frac{\partial l^*}{\partial N} \geq 0, \frac{\partial C_{\max}}{\partial n} \geq 0, \text{ and } \frac{\partial C_{\max}}{\partial N} \geq 0. \tag{4}$$

By assumption, an increase in the size of the family or community network lowers the entry cost of migration $C(n, N)$. Households with larger family and community networks are then more likely to send migrant because of both the lower costs of entry and the more affordable cost.

Thus far, both community and family networks have been treated symmetrically by the specification of the functions $m(n,N)$ and $v(n,N)$. The influence of these networks on the migration decision depends on how the networks interact in the production of information. If $m_{nN}(n,N) > 0$ and $v_{nN}(n,N) < 0$, then community and family networks are complements in the production of information; if $m_{nN}(n,N) < 0$ and $v_{nN}(n,N) > 0$, then community and family networks are substitutes in the production of information. We want to establish how the relationship between community and family networks influences migration.

$$\frac{\partial^2 l^*}{\partial n \partial N} = \frac{m_{nN} w - 2\phi\sigma_e^2\left(v_{nN} l^* + v_N \frac{\partial l^*}{\partial n} + v_n \frac{\partial l^*}{\partial N}\right)}{2\phi\left(\sigma_m^2 + v\sigma_e^2\right)}, \tag{5a}$$

$$\frac{\partial^2 C_{\max}}{\partial n \partial N} = \begin{cases} \frac{\partial^2 l^*}{\partial n \partial N}\left(mw - a + 2\phi L\sigma_m^2\right) + m_{nN} w l^* + m_N w \frac{\partial l^*}{\partial n} + m_n w \frac{\partial l^*}{\partial N} & \text{if } l^* < L, \\ L\left(m_{nN} w - \phi L \sigma_e^2 v_{nN}\right) & \text{if } l^* = L. \end{cases} \tag{5b}$$

The first term in the numerator of (5a) represents network influence via the expected return to migration. If networks are complements this term is positive, and if they are substitutes it is negative. The second set of terms represents the effects that come through changes in the variance of returns to migration. The first part is negative if the networks are complements and positive if they are substitutes. The second and third parts of this term represent effects that come through the change in allocation of labor to migration as network size increases. These effects are always positive because any increase (decrease) in network size improves (reduces) returns to migration. It follows that if community and family networks are complements in the production of information, then an increase in the family (community) network leads to a greater migration the larger the community (family) network. Such a strong statement cannot be made about the impact on migration if networks are substitutes. Following a similar line of reasoning provides the same results for the maximum affordable entry cost. Namely, if community and family networks are complements in the production of information, then an increase in the family (community) network leads to a greater maximum affordable entry cost the larger the community (family) network.

Examining entry costs, the role of the interaction between networks is unambiguous. If the networks are complements in providing assistance to migrants, $C_{nN}(n,N) > 0$, then the benefit – in reduced entry costs -- of increasing the family (community) network is greater for households with larger community (family) networks. Similarly, if the networks are substitutes, $C_{nN}(n,N) < 0$, then the benefit of increasing the family (community) network is lower for households with larger community (family) networks.

In conclusion, comparative statics results suggest that, as the size of family and community networks increases, the constraint imposed by the fixed cost is relaxed and the level of migration increases. Additionally, if the family and community networks are complements in the production of information, then we expect a positive relationship between the interaction of these variables and migration. If these networks are substitutes, then either a positive or a negative relationship between the interaction of these variables and migration can be found. The focus of the next three sections is to test these and the other comparative static results (3) to (5). Specifically, the following testable hypotheses about migration have been derived:

$$
\begin{aligned}
&l^* = \max\left(l^{**}\left(+L, -a, +s_m^2, +w, -s_e^2, +n, +N, \pm nN\right) L\right) \\
&s.t.\ \ C(-n, -N, \pm nN) \le C_{\max} = C_{\max}\left(+L, -a, +s_m^2, +w, -s_e^2, +n, +N, \pm nN\right)
\end{aligned} \qquad (6)
$$

where "–" denotes a negative relationship between the variable and migration, "+" denotes a positive $\pm$ " denotes an ambiguous relationship.

*2.3. Dynamic considerations*

The model developed in this paper to examine the role of migrant networks is static, taking migrant networks as given and allocating labor to migration or agriculture. Households, recognizing that networks reduce costs and improve returns to migration, should factor in the benefits of developing networks in the migration decision.[6] A dynamic model would incorporate not only the trade-off expressed in equations (1) and (2), but an additional component which, for each period, contains the future benefits of establishing migrant networks. This will make migration a more attractive option for households. The static model then underestimates the net benefits of migration. A dynamic model is not used here for two reasons. First, even with a dynamic model, the effects of migration hinge strongly on the initial network conditions. That is, network size in the initial period determines the optimal path for allocating labor; thus, the reduced form of the dynamic model is the same as that of the static model. Second, in practical terms, to distinguish between the "present" motivations for migration and the "future" motivations is not possible without panel data. Given that this is not available, a static model is sufficient to provide the necessary insights for empirical analysis.

**3. The data**

The data used in this study are from household level and ejido level surveys, which were administered in 1994 by the Office of the Secretary for Agrarian Reform of the Mexican Government. Questions about the current participation in migration and the history of migration of household members, including children of the household head who had permanently migrated, and questions on the migratory experiences of relatives of the household head were included in the household survey. These data provide a source of information which is quite exceptional by its geographical coverage of Mexico since surveys were conducted in all states except Chiapas (where there was social strife at the time), encompassing 275 ejidos and 1,543 households.[7] In addition to the migration portion of the household survey, questions about the

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[6] Establishing the relationship between the household migration decision and community networks could prove difficult. Community members could adopt, for example, a cooperative strategy in which some families send migrants earlier to establish a community network. A non-cooperative game is also possible. The household migration decision will depend partially on the community dynamics.

[7] The sampling design was based on a two-step procedure, with a stratified sampling of ejidos and random choice of ejidatario-households within the chosen ejidos. The variable used for the stratification of the ejidos was the average area of agricultural land per household in the ejido. The survey was designed to be representative at the state level. Ejidos are communities that were created by the land reform, with a well defined number of landed members called ejidatarios. Since the ejidatario status can only be transmitted to one heir and ejido land cannot be divided or sold, the number of ejidatarios has remained essentially

households' endowments in human, physical, and institutional assets were also asked. The ejido level survey asked ejido representatives questions about general characteristics of the ejido, the level of infrastructure development, and the organization of the ejido. Details of the surveys can be found in de Janvry, Gordillo, and Sadoulet (1997).

The unit of analysis for this study is the household. An individual is considered a member of the household if he/she currently lives in the household or if he/she is a child of the household head. An individual, who is listed as a relative of the household head but does not live within the household, is considered a part of the extended family, but not part of the household.[8] The household's labor endowment is the total number of household members who were over 14 years of age.

The survey identified not only current migrants of the household, but also previous migration by household members and the dates of the most recent migration. Current migrants in a household are defined as household members who were migrants at the time of the survey or migrated in the period between 1990 and 1994. By this definition, 5.8% of the adult household members are migrants and 12.4% of the households surveyed have one or more migrants and are considered migrant households. Table 1 provides descriptive statistics that contrast migrant and non-migrant households.

### *3.1. Household variables*

Household variables are presented in three categories: human capital assets, physical assets, and institutional assets. The data show that migrant households tend to have significantly more adult labor and the household head tends to be older. Migrant households have on average 2.15 migrants, which represents 30% of their labor force. While educational levels are low among both non-migrant and migrant households, the latter have a significantly lower average level of education.

All the indicators of physical assets owned -- land, large and small livestock, and mechanical assets -- are significantly different for migrant and non-migrant households, with higher values in migrant households. This result may indicate that 1) a certain amount of money is required to finance migration and therefore the poor would have difficulty mobilizing the necessary resources, and/or 2) households with migrants are likely to receive remittances which increase household income and improve their asset position through the purchasing of livestock and mechanical assets. This presents a problem for econometric analysis since it indicates that some of the wealth variables are endogenous. Since land in the ejido cannot be bought or sold, quality-adjusted land owned (measured in hectares of rainfed-equivalent land) is the only appropriate exogenous indicator of wealth.

Institutional assets include membership in registered and unregistered organizations. The former, such as credit unions and producers associations, are sanctioned by the government, while the latter are informal organizations for labor exchange, mutual assistance, and the production of local public goods. Membership in unregistered organizations is significantly larger among non-migrant households, indicating their greater commitment to and reliance upon the local community.

### *3.2. Network variables*

Two types of network are defined for the purpose of this study: family networks and community networks. They are further divided into historical and current networks. The purpose of examining both historical and

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constant, and all ejidatarios are landed. The social structure of most ejido villages now includes non-ejidatario households (non-landed or with private land from outside the ejido), and ejidatarios themselves may have acquired additional private land. The survey, however, only covers ejidatario-households, which therefore all participate in agricultural production.

[8] Note that because ejidatario status can largely only be inherited and inheritance is legally restricted to only one heir, father and sons will, in principle, never both be ejidatario-household heads, nor will two brothers or sisters beyond the first generation when the ejido was created. Hence, there can only be very limited cases of overlapping between the members (from both the household and the extended family) of two observations. Looking at the age structure of ejidos, 65% were created prior to 1962. If the youngest of those who became ejidatarios at the time of creation were 25 years old, they would have been 60 years old and retired at the time of the survey. In these ejidos, all members are thus second generation. In the 35% others, there may still be first generation ejidatarios, and hence potentially some brothers or kin. However, the sample size within an ejido is a maximum of 8%. It is hence very unlikely that two kin have been drawn in the survey.

current networks is to determine what type of network might be most useful to households for current migration. The historical migration family network is defined as the number of household members with migration experience between 1970 and 1989. Note that the concept of network is a concept of source of information and assistance coming from outside the current household migration experience. Hence, the historical network includes those household members who have migration experience, but have not been migrating since 1990. With this definition, 13.9% of the households have historical migration experience, which involves on average 1.05 members. Data reported in Table 1 shows that on average the historical family network is 1.9 times larger for migrant households than non-migrant households.

The current migration family network is defined as the number of current migrants in the extended family.[9] For an individual member of a household, information or assistance may come from any other household member who has migrated, and the whole family except him/herself could be counted in his individual current network. However, when the unit of analysis is the household, only members of the extended family can be included as belonging to the family current network. In this survey, we have information on a subset of the extended family composed of the brothers and sisters of the household head. The current family network is based on these data. Using this definition, 11% of the households have a current migration network, which on average consists of 1.74 kin of the household head. As can be seen from Table 1, the current family network is 1.6 times larger for migrant households than non-migrant households.

At the community level, specification of an appropriate network is more difficult. Networks must be defined to capture the source of public information and assistance provided to migrants. If networks are defined at the ejido or municipality level, this suggests that networks are restricted to these regions. Information on migration is likely to flow from each ejido to surrounding areas through kinship ties, market interactions, etc. In recognition of this, community networks are defined for each ejido by incorporating the migration experiences of the surrounding ejidos. Specifically, the location of each ejido was identified on a map of Mexico. Links were then drawn between each ejido and the three to five neighboring ejidos. A household's community consists of the ejido in which it resides along with the neighboring ejidos. As an example, consider three ejidos in Oaxaca: San Carlos, San Juan, and Santa Catarina. The community for each is defined as follows:

| *Ejido* | *Associated ejidos* |
|---|---|
| San Carlos | Santa Catarina, Oaxaca; Tontontepec, Oaxaca; Jesus Caranza, Veracruz |
| San Juan | Magdalena, Oaxaca; Santa Catarina, Oaxaca; Tontontepec, Oaxaca; San Sebastian, Oaxaca |
| Santa Catarina | Magdalena, Oaxaca; San Juan, Oaxaca; San Carlos, Oaxaca |

First, note that San Carlos is associated with Jesus Caranza, which is in the neighboring state of Veracruz – hence, networks are not a function of political boundaries. Second, San Carlos is associated with Santa Catarina and Santa Catarina is associated with San Carlos since information and assistance will flow in both directions. Third, while Santa Catarina is associated with both San Carlos and San Juan, San Juan and San Carlos are not associated. While Santa Catarina is close to the other two ejidos, the distance between San Juan and San Carlos suggests that there is little direct interaction. The end result is a set of overlapping communities with an individual ejido at the center. The relevant "community" is then ejido specific. For the remainder of this paper, when referring to "community" this is the definition.

As with family networks, for each of these ejido-centered communities, two community networks are defined reflecting respectively 1970-1989 historical migration and current migration. The historical community network is constituted by all the historical migration experiences of the households pertaining to the community – i.e., aggregating historical family networks across the community. Similarly, the current community network is constituted by aggregating current family networks living in the relevant community.

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[9] This definition of "current" migration may create some cases of time inconsistency. Because we have lumped together the period between 1990 and survey time as being an instantaneous "current" time, we could have the non-sensical case of a current dependent migration (in 1991) being explained by an independent "current" network migration of 1994. On the other hand, restricting current migration to being a migrant at the time of the survey or in 1994 only does not properly reflect the status of migration in Mexico, where migrants typically migrate on a sporadic basis, months in months out, or even years in years out.

Note that since historical and current family networks are exogenous variables then, by definition, historical and current community networks are exogenous variables since they are simply an aggregation of the family networks. Another issue relates to a problem of normalization. As the definition and limits of the community of any particular ejido is difficult to establish, we choose to normalize these migration networks by the size of the community labor force. The historical community network variable is therefore defined as the total number of household members in the community with historical, but not current migration experience, normalized by the labor force in the community. The current community network variable is the total number of household heads' kin with current migration experience in the community, also normalized by the labor force in the community. Hence, these community variables capture a concept of network density rather than one of size of a network. Table 1 shows that the migrant households' current and historical community networks are both about 1.6 times larger than non-migrant households' community networks.

### *3.3. Contextual variables*

Two categories of ejido and municipality variables are identified in Table 1: general characteristics and infrastructure development. Among the general characteristics, migrant households are more likely to pertain to ejidos that belong to a formal organization, and less likely to come from an ejido with an indigenous majority. Infrastructure variables represent the level of public investment in the ejido. The percentage of households in an ejido with a paved road is higher amongst migrant households. Paved road is admittedly a narrow indicator of public investment in the ejido. Yet, most other public investments or services may be a consequence more than a cause of high levels of migration, either because migrants effectively use their clout to lobby to obtain them (public telephone which they need to communicate with their kin) or, more importantly, because their construction requires co-financing by the community which is made possible by remittances. This endogeneity poses a problem for econometric analysis. Finally, the municipal marginality index measures the relatively high incidence of illiteracy, substandard housing, population in dispersed habitat, and poverty in a municipality.[10] It shows no significant difference between migrant and non-migrant households.

### *3.4. Distribution of households by regions*

Participation in migration is highly uneven across regions. The two regions with a share of migrant households in excess of their share of non-migrant households are the Center and North. These are the oldest regions of migration where networks are strongly entrenched. The two regions with equal shares of migrant and non-migrant households are the North Pacific and the South Pacific. Finally, the region with the smallest share of migrant compared to non-migrant households is the Gulf, where the largest future migration potential thus exists.

## 4. Empirical specification

The model and comparative statics presented in section 2 suggest testable hypotheses about the relationship between network variables and household migration. Following the theoretical model developed in section 2 and summarized in equation (6), the household migration decision may be viewed as occurring in two stages: first, whether or not to send migrants; and second, the amount of household labor to send. The theoretical possibility of households sending their whole labor force into migration does not occur in the data set we have, since only households with farm land were part of the survey. The stage 1 decision is:

$$d = \begin{cases} 1 & \text{if } C_{\max}\left(+L,-a,+\sigma_m^2,+w,-\sigma_e^2,+n,+N,\pm nN\right) - C(+n,+N,\pm nN) \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

while the optimal level of migration in the second stage decision (if $d = 1$) is:

$$l^* = l^*\left(+L,-a,+\sigma_m^2,+w,-\sigma_e^2,+n,+N,\pm nN\right) \quad \text{observed if } d = 1.$$

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[10] We use the 1970 marginality index (COPLAMAR, 1982) as opposed to the more recent 1990 index (CONAPO, 1993) to establish causality between marginality and migration.

Denote by $Z_h^a$ and $Z_c^a$ the household and community variables that influence the return to agriculture $(a, s_m^2)$, and denote by $Z_h^m$ and $Z_c^m$ the household and community variables that influence the return to migration $(w, s_e^2)$. A reduced form econometric model for the choice and level of migration can be reformulated as:

Choice of migration:

$$d^* = W\boldsymbol{g} + u_1,$$
$$d = 1 \text{ if } d^* > 0, \ 0 \text{ otherwise.}$$

Level of migration:

$$l^* = W\boldsymbol{b} + u_2, \quad \text{observed if } d = 1,$$

with $(u_1, u_2) \sim N(0, 0, 1, \boldsymbol{s}_2, \boldsymbol{r})$,

and $W = \{L, Z_h^a, Z_c^a, Z_h^m, Z_c^m, n, N, nN\}$.

Estimation of the model can be done using the two stage procedure suggested by Heckman, where the first stage is estimated using a maximum likelihood probit and the second stage by a truncated least squares regression.[11] In the second stage, unbiased estimates are obtained by including the inverse Mills ratio (IMR) for selectivity bias in the regression and errors are adjusted to reflect the heteroskedasticity that is present due to the relationship between the two regressions.

## 5. Results

The results of the probit on migration and the regression on the level of migration for migrant households are presented in Table 2. For the probit, marginal effects, calculated using sample enumeration, are presented rather than the coefficients. Since marginal effects have no meaning for dummy variables, a separate calculation comparing the change in probability as the dummy goes from zero to one is presented. For the least squares regression, the coefficient for each independent variable is presented. To determine which factors are important for migration, p-values for both individual variables and groups of variables are included.

### *5.1. Household variables*

All the human capital asset variables, except gender composition, affect the decision to migrate. Household size is positively and significantly related to both the decision to migrate and the level of migration. If there are decreasing returns to family labor in agriculture, this is not surprising since the opportunity cost to the family of sending a migrant is lower for larger households. Although not significant for the migration decision, household gender composition is significant for the level of migration, indicating that the level of migration is higher if there are more males in that household. For the decision to migrate, the age of the household head as well as the age squared are significant, implying an increasing, but diminishing influence of this variable on migration.

Education is negatively related to the migration decision, particularly at low levels of education, while literacy is positively related to migration. That education is negative in international migration is not surprising. Realizing a high return to education in a foreign country (average level of education is only 4.2 years) is difficult due to language barriers and, if migration is illegal, jobs that match education are not accessible. Those with mid-level education are more likely to migrate internally where the return to education is higher (Taylor, 1986). The coefficients on education and literacy jointly imply a nonlinear relationship between the decision to migrate and skill level. A certain minimum level of skill (literacy) is

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[11] We tested for adequacy of a Tobit specification. Results rejected the Tobit which presumes that the underlying relationship between each decision and the dependent variables is the same.

necessary for international migration, but the return to a higher level of education is low. Tests of joint significance show the importance of human capital assets on both decisions.

Land asset variables have positive coefficients on the linear term and negative coefficients on the quadratic term as expected if wealth has a positive and diminishing impact on migration. The signs of the terms support the argument that those with large levels of wealth, particular those with over 30 hectares of cropland, tend not to migrate. Additionally wealthy households, particularly those with over 15 hectares, send less migrants. Institutional assets are not found to be individually or jointly significant for either regression. There is hence no evidence that strong, locally developed social ties reduce migration.

*5.2. Network variables*

To explore the relationship between family and community networks in the migration decision, an interactive term between the two network variables is included for both historical and current migration. For the decision to migrate, historical networks are not found to significantly influence the migration decision although they are jointly significant at the 90% level.

The coefficients on current migration network variables are all significant, confirming the importance of networks in the migration decision. Both family and community current networks have positive signs and the interactive term is negative suggesting that these networks are substitutes. Examining the effect of current migration, when there are no current community networks, an increase in the current family network by one person increases the household's probability of migration by 5.4%. If the fraction of migrants in the current community network increases by 1%, and there is no current family network, a 0.9% increase in migration by members of that network is anticipated. However, since the sign of the interactive term is negative, if the current family network is equal to one then a 1% increase in the size of the current community network leads to only a 0.2% increase in the probability of migration. The value of increasing the size of the current community (family) network is thus substantially less for households with a current family (community) network.

The choice of the level of migration is positively influenced by historical family networks, and current community networks. This suggests that if a family has a history of migration, it is more likely to send additional migrants than a family without such a history. Similarly, if a community currently has a lot of migrants, then households in that network are likely to send more migrants than those with a small current community network.

*5.3. Contextual variables*

At the ejido level, several variables are found to significantly influence the choice and level of migration. The presence of a majority indigenous population reduces the choice and level of migration. This is likely due to a combination of language barriers and discrimination in United States labor markets. The quality of infrastructure, measured by the availability of a paved road to access the ejido, helps reduce the level of migration. Hence, public investment in infrastructure can be effective in helping reduce the number of migrants from rural areas. At the municipality level, marginality positively influences the migration decision and the level of migration. This suggests that households in historically poorer municipalities with less amenities and less local options are more likely to migrate and send more migrants.

The IMR is positive in the level of migration equation. This indicates that households who chose to migrate have underlying characteristics which would induce a number of migrants higher than in the population at large.

## 6. Role of community networks in migration

In section 2, we argued the value of migrant networks in providing information for migration and direct assistance to migrants. The argument is based on the hypothesis that access to information and assistance via family and community networks alters the distribution of returns to migration and therefore changes the migration decision. In section 5, the importance of migrant networks was confirmed by the positive sign and the strong significance of current family and community networks in the decision to migrate and the significance of historical family networks and current community networks in the choice of the number of household members to send. However, if the information and assistance which community networks provide sufficiently alters the distribution of returns to migration, then the variables that explain migration may differ for households with and without access to community networks. We test this hypothesis in this section.

The majority of households have access to some community network. To classify the households by community networks, we want to identify those with significant access to community networks. This is assumed to be those with a notable level of both current and historical community migration, defined here as communities with current networks of more than 3 migrants per 100 community workers and historical networks of more than 2 migrants per 100 household workers.[12] Of the households surveyed, 28% fall into this category. For each category the results of the probit are presented in Table 3a and of the least squares regression in Table 3b. Examining the results of the probits, the household variables representing skill level are significant for households with small community networks but not for those with large community networks.[13] This suggests that, if a household has sufficient access to community networks, then skill level becomes less of a factor in the migration decision. Family networks are insignificant for households with large community networks, confirming the substitute nature of community and family networks: with widespread community information and assistance available, family information and assistance is less useful. However, current family networks are significant for households with small community networks: family information and assistance are important for households without access to extensive community information and assistance.

When community networks are small, the presence of formal organizations at the ejido level and the historical level of municipal marginality increase migration while presence of a majority indigenous population reduces migration. All these effects disappear once large community networks exist. Interestingly, infrastructure development is significant for households with large community networks, suggesting that infrastructure investment may not help deter migration once large networks are in place.

Results for the least squares regressions on the level of migration presented in Table 3b provide an interesting contrast between households with limited and extensive access to community networks. The regression for households with only small community networks has numerous significant variables including household variables (household size, age of the household head, and the level of household literacy), current family networks, and most of the contextual variables. In contrast, none of these variables except infrastructure are found to be significant for households with large community networks. Additionally, note that the conditional marginal effects are generally larger for households with small community networks. Availability of large community networks thus overwhelms individual household and contextual characteristics in determining the level of migration. As a result, households with the initially least favorable characteristics for migration benefit most from the consolidation of community networks. With these networks in place, all households can partake in migration and local development has little (or less in the case of roads) impact in slowing down migration. This is also confirmed by the IMR: while for households with small community networks the selectivity bias in choosing to migrate is toward households who would send more migrants, this bias is reversed when large community networks prevail. As the role of individual characteristics vanishes, the selectivity bias in migration is now toward individuals who would send less migrants.

## 7. Migrant destination

Thus far, analysis of the data on migration has established a positive relationship between migrant networks and the decision to send migrants. However, if networks provide information and direct assistance to migrants, then networks should influence not just whether households send migrants but where the migrants go. In this section, we explore migrant destinations and the role of networks.

The literature on migrant networks notes that the most common migration is for multiple migration destinations, or nodes, for a given network (Cornelius, 1991; Wilson, 1994; Massey et al., 1987). The

[12] Since the average community current network is larger than the historical network, we intentionally chose the higher value for current networks.

[13] We choose to conduct this empirical analysis with a dichotomy between "small" and "large" networks. This is for empirical reasons more than theoretical reasons. The more likely effect is a degradation of the importance of personal characteristics as migration is more developed in the area rather than the existence of a threshold level. An alternative way to empirically test this phenomenon was to have interactive effects between network size and all the other variables, in so doing imposing a linear relationship. The splitting of the sample as we do it is somewhat arbitrary, but less demanding and it produces sharper contrast.

pattern of migration is one in which a few “foragers” searching for jobs in the U.S. initiate migration. Once established at a given location, this location forms a node in the network. While in the United States, some migrants may hear of opportunities in other locations and move to those locations or go there on subsequent migrations, setting up another node in the network. Data on migration destinations are, therefore, not expected to show that all migrants from a network go to a single destination. This does not, however, mean that the pattern of destinations is random. For example, of the 181 crossings into the United States from a community in Jalisco, 37% went to the California agricultural sector, 33% went to Los Angeles County, 15% went to Milwaukee, and 14% to other destinations (Wilson, 1994). If networks play a role in the choice of destination, we expect to observe that migrants from a given network go to different locations, but that there tends to be a few key destinations per network.

In the 1994 household survey, there were 193 households that sent migrants to the United States (see Table 1). For a subset *M* of these households (61 migrants), data are available on both the migrant destination and the destinations of network migrants. Destinations can be grouped in six regions within the United States as follows: Southern California, Northern and Central California, Southwest, Northwest, Central U.S. (including Texas), and the East. Let the destination of migrant *i* be defined by a dichotomic variable as follows:

$$d_{ij} = 1 \text{ if } i \text{ migrated to region } j,$$
$$= 0 \text{ otherwise}, \quad j = 1,\dots,6, \quad i = 1,\dots,M,$$

and the destinations of his network be defined for all *i* by:

$$x_{ij} = M_{ij} / M_i, \quad j = 1,\dots,6, \quad i = 1,\dots,M,$$

where $M_i$ is the total number of migrants in network *i* and $M_{ij}$ the number in destination *j*. $x_{ij}$ is then the fraction of household *i*‘s migrant network in destination *j*.

The first row in Table 4 shows the regional destinations of household migrants, i.e., the average of $d_{ij}$ over all migrants $i = 1,\dots,M$. The majority of migrants went to Southern California (36.1%), followed by the Central U.S. (19.7%), and the Southwest (18%). The second row of Table 4 reports the average of the network destinations $x_{ij}$ over all networks $i = 1,\dots,M$:

$$\frac{1}{M}\sum_i x_{ij} .$$

As would be expected, network destinations correspond to the destinations of household migrants. The third row of Table 4 reports the average share of the network in the destination in which the migrant went. This is computed as follows for all destinations $j = 1,\dots M$:

$$\frac{\sum_i d_{ij} x_{ij}}{\sum_i d_{ij}} .$$

Migrants that went to Southern California had on average 42.8% of their networks in Southern California, while networks overall only have 31.7% of their members in the region, and migrants that went to the Southwest had 38.7% of their networks in the region while networks overall have 13.1% of their members in the Southwest. All numbers reported in row 3 are larger than their corresponding values in row 2. This indicates that migrants went to destinations where their networks were more established than on average.

A more systematic approach is the use of a conditional logit. The migrant must choose between the six possible regions. In making this choice, the migrant considers, for each region, the size of the network it has in that particular region. If migrant networks provide information and assistance that enhance the expected returns to migration, then the destination decision will be influenced by the size of the network in the region. We also include a fixed effects for each region (with Southern California as the base case) in order to account for the attractiveness of the destination independently of the networks. The model is thus written:

$$U_{ij} = a_j + bx_{ij} + u_{ij},$$

$$\text{prob}\left(d_{ij} = 1\right) = \frac{e^{a_j + bx_{ij}}}{\sum_k e^{a_k + bx_{ik}}},$$

where $U_{ij}$ is the index function representing the utility of destination $j$ for migrant $i$, and $u_{ij}$ an error term accounting for the random events not accounted for in the model. Table 5 reports the results of this estimation. Odds ratios $e^{a_j}$ for the regions show that all regions attract less migrants than Southern California (the odds ratio for Southern California being by normalization equal to 1), although the parameter is only significant for the Northwest. The significant parameter $b$ clearly indicates that the network destination has a positive and significant impact on the individual destination of migrants. The corresponding odds ratio says that the probability of migrating to a region where 100% of the network is settled is 18.5 times higher than where the network has no settlement (with 6 destinations, the probabilities are 78.7% for the network region and 4.2% for all other regions). This ratio is 10 for a region where 80% of the network is settled, and 5.6 for a region where 60% of the network is settled.

**8. Conclusions**

In this paper, data from a national survey of rural Mexican households were used to test hypotheses regarding the role of family and community networks in migration from Mexico to the United States. Four major conclusions were reached.

(1) Results strongly support the positive influence of migrant networks on both the decision to migrate and the number of migrants to send, as had been previously argued by Massey and García España (1987). Information regarding migration and direct assistance may come from the historical experiences of family and community members, and from current migrants from the family and the community. Results indicate that current family and community networks play a greater role in the migration decision than historical migration. For the decision on the level of migration, historical family migration and current community migration play the most significant roles.

(2) Since information about migration and assistance in migration can be obtained from family and/or community networks, the relationship between these networks was explored. The results indicate that family and community networks are substitutes in the generation of information and direct assistance. This implies that households with weaker family networks derive more benefit from community networks than those with larger family networks.

(3) In communities without strong established networks, the migration decision and the level of migration are strongly influenced by household (household size, age of household head, educational level, literacy, family networks), ejido (existence of formal organizations, ethnicity), and municipality (extent of marginality) factors. However, once community networks are strongly established, these factors become largely irrelevant in explaining migration. Even households with initially adverse characteristics for migration, and without access to family networks, are able to migrate. Thus, once community networks are established, migration becomes generalized and hard to detain. This supports the theory of "cumulative causation" of migration, which is the tendency for international migration to follow its own dynamic, regardless of the original conditions (Massey et al., 1994a). An example is the analysis of data from 19 Mexican communities by Massey, Goldring, and Durand (1994b) which shows that, although migration begins within a narrow, identifiable range of a community's socioeconomic structure, it broadens over time to include other social groups. Our result, based on individual data, therefore sharpens their conclusion by explicitly testing for the relative role of individual characteristics and networks.

(4) In general, investment in rural development is expected to reduce incentives to migrate. This was suggested by Taylor et al. (1996) who argue that the primary motive for migration was to compensate for local capital and risk market failures, and hence that a government that wishes to reduce out-migration should offer households alternative sources of credit and insurance. In our analysis, this was seen by the role of municipal marginality as a cause of migration and to some extent by the role of investment in roads in reducing migration. These results have to be taken with caution since marginality reflects more than just rural development efforts and roads are admittedly a narrow indicator of public investment. However, once strong community networks are in place, reducing the level of municipal marginality (at least within the range of marginality reduction observed) would no longer be effective in stemming migration. This

suggests that rural development efforts designed at inhibiting migration should be targeted at communities where levels of marginality are high and where migrant networks are not yet firmly established.

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**Table 1. Non-migrant versus migrant households**

| | *Non-migrant households* | *Migrant households* [1] | *Test of difference* [2] |
|---|---|---|---|
| Percent of total number of households | 87.6 | 12.4 | |
| Number of migrants per household | 0 | 2.15 | |
| **Household variables** | | | |
| *Human capital assets* | | | |
| Household size (number of adults) | 4.2 | 7.2 | ** |
| Gender composition (% of males) | 56 | 55.7 | |
| Age of household head | 48.0 | 58.0 | ** |
| Education level (average number of years among adults) | 4.7 | 4.2 | ** |
| Household literacy (% of literate adults) | 85 | 83.9 | |
| *Physical assets* | | | |
| Land owned (hectares of rainfed equivalent) | 5.3 | 7.0 | ** |
| Large livestock owned (number of animals) | 1.1 | 1.5 | ** |
| Small livestock owned (number of animals) | 21.2 | 30.3 | ** |
| Mechanical assets owned (number of large machines) | 0.3 | 0.5 | ** |
| *Institutional assets* | | | |
| Household membership in an organization (%)+ | 44.5 | 42.2 | |
| Registered organization (%)+ | 24.1 | 28.1 | |
| Unregistered organization (%)+ | 25.3 | 16.7 | ** |
| **Network variables** | | | |
| *Family networks (number of migrants)* | | | |
| Historical migration (1970-1989) | 0.09 | 0.17 | ** |
| Current migration | 0.18 | 0.28 | * |
| *Community networks (% of adults)* | | | |
| Historical migration (1970-1989) | 1.8 | 2.8 | ** |
| Current migration | 3.4 | 5.6 | ** |
| **Contextual variables** | | | |
| *Ejido level* | | | |
| Ejido member of a formal organization (%)+ | 42 | 50 | ** |
| Ejido with majority indigenous (%)+ | 13.9 | 3.3 | ** |
| Share of irrigated in total ejido land (%) | 16.1 | 14.2 | |
| Ejido with paved road (%)+ | 25.1 | 30.2 | ** |
| *Municipal level* | | | |
| Municipal marginality index (1970) | -1.0 | -1.5 | |
| **Distribution of households by regions (%)** | | | |
| North | 23.9 | 29.7 | * |
| North Pacific | 12.9 | 8.9 | |
| Center | 23.9 | 39.1 | ** |
| Gulf | 16.3 | 1.6 | ** |
| South Pacific | 23 | 20.8 | |

[1] Households with at least one migrant during the 1990-94 period.

[2] Test of difference between non-migrant and migrant households: t-test for means, chi-squared for percentages.

*= significant at 90%, **= significant at 95% .

+ Dummy variables.

**Table 2. Decision to migrate and level of migration: Heckman two-step procedure**

| | *Decision to migrate: probit* | | | | | *Level of migration: truncated LS* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Marginal effects* | *p-value individual variables* | | *p-value groups of variables* | | *Regression coefficients* | *p-value individual variables* | | *p-value groups of variables* | |
| Constant | - | 0.000 | *** | | | -6.130 | 0.017 | ** | | |
| Inverse Mill's ratio | | | | | | 0.686 | 0.000 | *** | | |
| **Household variables** | | | | | | | | | | |
| *Human capital assets (L, $Z_h^a$, $Z_h^m$)* | | | | | | | | | | |
| Household size | 0.031 | 0.000 | *** | 0.000 | *** | 0.427 | 0.000 | *** | 0.000 | *** |
| Gender composition | 0.023 | 0.562 | | | | 0.994 | 0.060 | * | | |
| Age of household head | 0.014 | 0.007 | *** | | | 0.076 | 0.383 | | | |
| Age of household head squared | -0.0001 | 0.013 | *** | | | -0.0004 | 0.556 | | | |
| Education level | -0.036 | 0.000 | *** | | | -0.082 | 0.539 | | | |
| Education squared | 0.002 | 0.008 | *** | | | -0.003 | 0.759 | | | |
| Household literacy | 0.094 | 0.016 | ** | | | 1.313 | 0.013 | *** | | |
| *Land assets ($Z_h^a$)* | | | | | | | | | | |
| Land owned | 0.003 | 0.094 | * | 0.231 | | 0.025 | 0.287 | | 0.020 | ** |
| Land owned squared | -0.0001 | 0.196 | | | | -0.001 | 0.030 | ** | | |
| *Institutional assets ($Z_h^a$, $Z_h^m$)* | | | | | | | | | | |
| Membership in a registered organization+ | -0.017 | 0.323 | | 0.541 | | -0.178 | 0.411 | | 0.351 | |
| Membership in an unregistered organization+ | -0.011 | 0.561 | | | | -0.346 | 0.196 | | | |
| **Network variables** | | | | | | | | | | |
| *Historical migration* | | | | | | | | | | |
| Family network (*n*) | 0.057 | 0.106 | | 0.092 | * | 0.784 | 0.080 | * | 0.025 | ** |
| Community network (*N*) | 0.006 | 0.113 | | | | -0.027 | 0.593 | | | |
| Family*Community (*nN*) | -0.005 | 0.557 | | | | -0.010 | 0.934 | | | |
| *Current migration* | | | | | | | | | | |
| Family network (*n*) | 0.054 | 0.001 | *** | 0.000 | *** | 0.084 | 0.538 | | 0.252 | |
| Community network (*N*) | 0.009 | 0.000 | *** | | | 0.053 | 0.046 | ** | | |
| Family*Community (*nN*) | -0.007 | 0.009 | *** | | | -0.015 | 0.605 | | | |
| **Contextual variables** ($Z_c^a$, $Z_c^m$) | | | | | | | | | | |
| *Ejido level* | | | | | | | | | | |
| Ejido member of a formal organization+ | 0.020 | 0.185 | | 0.024 | ** | 0.200 | 0.304 | | 0.010 | *** |
| Ejido with majority indigenous+ | -0.048 | 0.088 | * | | | -0.983 | 0.044 | ** | | |
| Share of irrigated in total ejido land | -0.033 | 0.232 | | 0.480 | | 0.385 | 0.319 | | 0.131 | |
| Ejido with paved road+ | -0.002 | 0.892 | | | | -0.405 | 0.060 | * | | |
| *Municipal level* | | | | | | | | | | |
| Municipal marginality index | 0.003 | 0.018 | ** | | | 0.044 | 0.006 | *** | | |

| | | | | | |
|---|---|---|---|---|---|
| Number of observations | 1543 | | | Number of observations | 192 |
| Prediction success table[1] | actual | 0 | 1 | R-squared | 0.41 |
| | predicted 0 | 1297 | 54 | | |
| | 1 | 130 | 62 | | |
| | % correct | 91 | 53 | | |

[1] Prediction based on whether the predicted probability of migration is greater than 40%.

*= significant at 90%, **= significant at 95%, ***=significant at 99% .

+ Dummy variables.

**Table 3a. Decision to migrate by size of community network: Probits**

| | ***Small Community Networks*** | | | | | ***Large Community Networks*** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Marginal effects* | *p-value individual variables* | | *p-value groups of variables* | | *Marginal effects* | *p-value individual variables* | | *p-value groups of variables* | |
| Constant | - | 0.000 | *** | | | - | 0.002 | *** | | |
| | | | | | | | | | | |
| **Household variables** | | | | | | | | | | |
| *Human capital assets* | | | | | | | | | | |
| Household size | 0.023 | 0.000 | *** | 0.000 | *** | 0.047 | 0.000 | *** | 0.000 | *** |
| Gender Composition | 0.021 | 0.649 | | | | 0.054 | 0.562 | | | |
| Age of household head | 0.013 | 0.034 | ** | | | 0.024 | 0.047 | ** | | |
| Age of household head squared | -0.0001 | 0.068 | * | | | -0.0002 | 0.046 | ** | | |
| Education level | -0.033 | 0.002 | *** | | | -0.028 | 0.211 | | | |
| Education squared | 0.002 | 0.045 | ** | | | 0.002 | 0.324 | | | |
| Household literacy | 0.107 | 0.013 | ** | | | -0.007 | 0.941 | | | |
| *Land assets* | | | | | | | | | | |
| Land owned | 0.003 | 0.202 | | 0.270 | | 0.008 | 0.323 | | 0.613 | |
| Land owned squared | -0.00003 | 0.514 | | | | -0.0002 | 0.372 | | | |
| *Institutional assets* | | | | | | | | | | |
| Membership in a registered organization+ | -0.016 | 0.405 | | 0.271 | | -0.227 | 0.557 | | 0.647 | |
| Membership in an unregistered organization+ | -0.030 | 0.138 | | | | 0.040 | 0.447 | | | |
| | | | | | | | | | | |
| **Network variables** | | | | | | | | | | |
| *Historical migration* | | | | | | | | | | |
| Family network | 0.010 | 0.732 | | 0.036 | ** | 0.063 | 0.137 | | 0.322 | |
| *Current migration* | | | | | | | | | | |
| Family network | 0.030 | 0.020 | ** | | | -0.001 | 0.968 | | | |
| | | | | | | | | | | |
| **Contextual variables** | | | | | | | | | | |
| *Ejido level* | | | | | | | | | | |
| Ejido member of a formal organization+ | 0.054 | 0.003 | *** | 0.002 | *** | -0.030 | 0.388 | | 0.796 | |
| Ejido with majority indigenous+ | -0.054 | 0.032 | ** | | | 0.026 | 0.849 | | | |
| Share of irrigated in total ejido land | -0.014 | 0.620 | | 0.325 | | -0.096 | 0.196 | | 0.037 | ** |
| Ejido with paved road+ | -0.027 | 0.171 | | | | 0.079 | 0.037 | ** | | |
| *Municipal level* | | | | | | | | | | |
| Municipal marginality index | 0.002 | 0.075 | * | | | 0.001 | 0.737 | | | |
| | | | | | | | | | | |
| Number of observations | 1110 | | | | | 433 | | | | |

Prediction success table[1]

| | Small: actual 0 | Small: actual 1 | Large: actual 0 | Large: actual 1 |
|---|---|---|---|---|
| predicted 0 | 983 | 22 | 315 | 31 |
| predicted 1 | 78 | 27 | 48 | 39 |
| % correct | 93 | 55 | 87 | 56 |

[1] Prediction based on whether the predicted probability of migration is greater than 40%.

*= significant at 90%, **= significant at 95%, ***=significant at 99% .

+ Dummy variables.

**Table 3b. Level of migration by size of community network: Truncated least squares**

| | *Small Community Networks* | | | | | *Large Community Networks* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Regresion coefficient* | *p-value individual variables* | | *p-value groups of variables* | | *Regresion coefficient* | *p-value individual variables* | | *p-value groups of variables* | |
| Constant | -24.224 | 0.001 | *** | | | 1.734 | 0.725 | | | |
| Inverse Mill's ratio | 3.174 | 0.000 | *** | | | -1.233 | 0.020 | *** | | |
| **Household variables** | | | | | | | | | | |
| *Human capital assets* | | | | | | | | | | |
| Household size | 0.776 | 0.000 | *** | 0.000 | *** | 0.117 | 0.157 | | 0.054 | * |
| Gender Composition | 1.508 | 0.297 | | | | 0.631 | 0.467 | | | |
| Age of household head | 0.441 | 0.088 | * | | | -0.043 | 0.762 | | | |
| Age of household head squared | -0.003 | 0.136 | | | | 0.001 | 0.624 | | | |
| Education level | -0.682 | 0.052 | * | | | 0.126 | 0.557 | | | |
| Education squared | 0.024 | 0.437 | | | | -0.014 | 0.416 | | | |
| Household literacy | 3.000 | 0.032 | ** | | | 1.286 | 0.124 | | | |
| *Land assets* | | | | | | | | | | |
| Land owned | 0.068 | 0.337 | | 0.601 | | -0.025 | 0.656 | | 0.622 | |
| Land owned squared | -0.001 | 0.319 | | | | 0.001 | 0.459 | | | |
| *Institutional assets* | | | | | | | | | | |
| Membership in a registered organization+ | -0.498 | 0.367 | | 0.164 | | -0.080 | 0.804 | | 0.891 | |
| Membership in an unregistered organization+ | -1.385 | 0.073 | * | | | -0.181 | 0.663 | | | |
| **Network variables** | | | | | | | | | | |
| *Historical migration* | | | | | | | | | | |
| Family network | 0.508 | 0.521 | | 0.132 | | 0.350 | 0.391 | | 0.692 | |
| *Current migration* | | | | | | | | | | |
| Family network | 0.547 | 0.064 | * | | | -0.036 | 0.834 | | | |
| **Contextual variables** | | | | | | | | | | |
| *Ejido level* | | | | | | | | | | |
| Ejido member of a formal organization+ | 1.399 | 0.008 | *** | 0.001 | *** | -0.043 | 0.890 | | 0.825 | |
| Ejido with majority indigenous+ | -2.132 | 0.064 | * | | | -0.347 | 0.781 | | | |
| Share of irrigated in total ejido land | 0.883 | 0.318 | | 0.189 | | 0.453 | 0.489 | | 0.049 | ** |
| Ejido with paved road+ | -1.170 | 0.095 | * | | | -0.764 | 0.017 | *** | | |
| *Municipal level* | | | | | | | | | | |
| Municipal marginality index | 0.141 | 0.004 | *** | | | -0.021 | 0.395 | | | |
| Number of observations | 105 | | | | | 87 | | | | |
| R-squared | 0.48 | | | | | 0.45 | | | | |

*= significant at 90%, **= significant at 95%, ***=significant at 99% .

+ Dummy variables.

**Table 4. Migrant destinations**

| | Southern California | North-Central California | Southwest | Northwest | Central | East |
|---|---|---|---|---|---|---|
| Migrant's destination | 36.1% | 11.5% | 18.0% | 3.3% | 19.7% | 11.5% |
| Network destinations | 31.7% | 10.3% | 13.1% | 2.7% | 26.9% | 15.0% |
| Network share in migrant's destination | 42.8% | 28.0% | 38.7% | 4.0% | 45.4% | 35.7% |

**Table 5. Choice of destination**

Conditional logit on choice of destination for each migrant

| | Coefficient | Odds Ratio | P-value |
|---|---|---|---|
| **Regional dummies** | | | |
| Southern California | | 1.00 | |
| North-Central California | -0.46 | 0.63 | 0.328 |
| Southwest | -0.17 | 0.85 | 0.698 |
| Northwest | -1.38 | 0.25 | 0.076 |
| Central | -0.62 | 0.54 | 0.132 |
| East | -0.71 | 0.49 | 0.126 |
| **Network density at destination** | 2.92 | 18.5 | 0.000 |

Number of observations 366 = (61 x 6 destinations)