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Abstract

Prior research on Mexican migration has shown that social networks and economic incentives play an important role in determining migration outcomes. This study utilizes experimental data on PROGRESA, Mexico's primary poverty reduction program, to evaluate the effects of public cash transfers on migration. Our study complements a growing body of literature aimed at overcoming longstanding hurdles towards the establishment of causal validity in empirical studies of migration. We find that public cash transfers reduce US migration but have little effect on domestic migration. Furthermore, we find that the provision of cash transfers appears to reduce migration partly by reducing the relative deprivation levels of poor households. Finally, we find that the effect of public cash transfers on US migration depend on the size of existing US migration networks. Surprisingly, we see that transfers have larger (more negative) effects on US migration in communities with large existing networks. The results suggest that public transfers may be helpful in managing rural out-migration, particularly to the US. Interestingly, such programs may be most effective if they are targeted towards communities with strong existing migration patterns.

Key Words: Migration, Mexico, PROGRESA, Public Transfers, Relative Deprivation, Networks

JEL: I38, J18, O15

I. Introduction

Insight into the determinants of both domestic and international migration and how these determinants might be mediated through public policy have been slow to emerge from the social science literature (Massey et al. 1993; Massey et al. 1994a). The issue is of central importance to Mexican and US policymakers given the historically high levels of domestic migration within Mexico and international migration to the United States. While this migration has brought significant economic benefit to the Mexican economy and millions of Mexican families, the costs are also high, including excessive urbanization, social dislocation, loss of life and political tension.

In this study, we make use of data on Mexico's large-scale and innovative poverty reduction program, PROGRESA, to study migration behavior. The PROGRESA program included an experimental evaluation whereby publicly-funded cash transfers were provided to eligible households in a randomly selected group of communities. Although not explicitly designed to reduce rural out-migration, by altering the economic conditions at the point of origin through cash transfers to poor rural households the PROGRESA program offers a unique opportunity to evaluate the effect of changing household resources on rural out-migration. The experimental design allows us to compare the difference in behavior of treatment and control households and be reasonably certain that it is the treatment itself that leads to changes in household migration rather than any observable or unobservable initial conditions.

Our study complements a growing body of literature aimed at overcoming longstanding hurdles towards the establishment of causal validity in empirical studies of migration. Major remaining sources of uncertainty include our limited ability to overcome issues of migrant selectivity (Chiswick 1978; Mueser 1989) and recall bias (Smith and Thomas 2003) that greatly reduce the usefulness of cross-sectional survey data on migration. This problem is exacerbated once we consider that household income is itself endogenous to prior migration of one or more household members (Stark and Taylor 1989). Recent efforts such as the use of multilevel hazard models along with Heckman selection methods (Palloni et al. 2001) or the use of fixed-effect methods with panel data to overcome migrant selectivity concerns (Munshi 2003) highlight important econometric methodologies that have increased our understanding of causal processes in migration research. Ideally, of course, causal validity would be best served were it possible to use experimental data to determine the causes of migration.

Since PROGRESA was targeted at rural poverty, the data are well suited to analyze both rural to urban (domestic) and rural to the United States (international) migration. In examining the effects of PROGRESA, we analyze how changes in the absolute level of income and relative level of income (with respect to their home community) affect household migration decisions. The analysis of the effects of PROGRESA through changes in relative income is possible because data is available for all households in the community. The richness of the data also allows the examination of the effects of social networks on migration and whether such networks mediate the influence of cash transfers on the migration decisions. Our study therefore aims to incorporate two related foci of migration research. One is the study of the nature of social relationships that influence the persistence of migration as well as on the institutional context of migration decisions (Boyd 1989; Massey et al. 1993; Palloni et al. 2001). Another is on the varied and complex economic determinants of migration decision making (Harris and Todaro 1970; Stark 1991; Todaro 1969). Thus, we evaluate the separate and complementary roles of both social and economic determinants of migration.

Examining the influence of changing household income levels on rural out-migration requires careful consideration of the theoretical models of migration and the mechanism by which resource levels and transfers enter into these models. In this paper, we consider three models of migration: the neo-classical model, the new economics of migration including the role of relative deprivation and the network theory of migration. Each of these models is carefully considered in section II focusing on how the provision of public transfers to rural households is expected to alter the migration decision. Following this discussion, in section III the PROGRESA program is described as are the data used for this analysis. Section IV describes the empirical strategy used to test the hypothesis developed in section II and presents the results of that analysis. Finally, in section V conclusions and policy implications are drawn.

II. Theories of migration and the role of public transfers

Poor households in rural areas of developing countries are severely constrained in their natural, physical, human, financial and social capital assets, which limits their ability to generate income as well as weather the risks inherent to their local environments. Migration to urban centers or international destinations is a potential mechanism for poor households to both increase and diversify their income. Public cash transfers, such as those provided by PROGRESA, have the potential to influence the economic calculation of individuals and households and to modify migration patterns. Furthermore, examining how public transfers affect migration also provides insight into how income and income changes may affect migration decisions.

Economic analysis of the migration decision has been guided by a series of theoretical models. Neo-classical models of migration consider the migration decision in a cost-benefit framework where potential migrants compare the expected income at the point of origin to the expected net income at possible migration destinations (Harris and Todaro 1970; Sjaastad 1962; Todaro 1969). Expectations of net income from any location depend on the characteristics of the individual, such as age, skill level and asset position, and will thus vary by individual. A cash transfer program provided to a poor family alters the expected income at the point of origin to the household to which the individual belongs. This increases the expected income for the potential migrant and is thus expected to lower the probability of migration. Note, however, that cash transfers are generally targeted at a single household member, which in the case of PROGRESA, is the primary female in the household. While clearly altering the returns to staying at the point of origin for that individual, it may not do so for other individuals in the household. Much depends on the conditions placed on the receipt of transfers (see below). Given that transfers are linked to the presence of household members in the case of PROGRESA, we expect this to deter migration, at least for some members of the household, and particularly for larger distances, where it is not easy to move back and forth.

After years of dominating the economic view of migration, a new theory referred to as the "new economics of migration" rose to challenge some of the assumptions and conclusions of the neo-classical theory based on the key insight that migration decisions are not necessarily made in isolation by individuals but by larger units of related people, particularly households (Massey et al. 1993). From this perspective, the decision to migrate may be considered a joint household decision with the household sharing the costs and benefits of migration with the migrant through an explicit or implicit sharing rule. The household uses migration as one mechanism for diversifying risk and gaining access to capital in the presence of market imperfections in the credit and insurance markets (Stark and Bloom 1985; Stark and Levhari 1982). The introduction of a program that provides cash to the household will influence this allocation decision. First, assuming the program is well managed, the cash transfer will reduce the uncertainty of income at the point of origin. Second, the provision of cash is likely to reduce the household's credit constraint. This is shown to be the case for PROCAMPO, another transfer program in Mexico linked to agriculture (Sadoulet, De Janvry and Davis 2001).

The new economics of migration questions the view that absolute income is the only factor in migration; instead, the theory argues that the income of the migrant relative to the distribution of income of some reference group such as the village will also influence the decision (Stark 1984). If a household feels relatively deprived within a community, it is expected to be more likely to migrate. An early study on migration from Mexico to US shows that the initial relative deprivation of the households to its village reference group plays an important role in the migration decision (Stark and Taylor 1989). Given that anti-poverty cash transfers target poorer households within communities, such programs should reduce the relative deprivation of those poor households and thus reduce the probability they will migrate. A cash transfer program like PROGRESA thus will have an effect not only on absolute income, but also on relative income.

Based on the empirical observation that migration streams often develop in particular communities and regions, the network theory of migration highlights the importance of direct and indirect relationships in the migration decision (Boyd 1989). Migrant networks can be viewed as a form a social capital (Massey, Goldring and Durand 1994b) -- that is migration-specific – which influences the migration decision in two ways. First, members of the network may provide direct assistance to migrants in the form of food, housing, transportation or cash which reduces the costs of migration. Second, network members may provide information to potential migrants on job opportunities, circumventing a border, etc. that alters the idiosyncratic returns to migration. Migrant networks therefore increase the expected returns and reduce the risk and costs associated with migration.[1] As migrant networks form and thicken, they serve as a catalyst for the migration of family members of network migrants as well as community members at the point of origin. Empirical evidence

[1] Information provided by migrant networks, such as an economic downturn or crackdown at a border, could potentially reduce the expected returns to migration. In net, however, we assume that the information has a positive influence on returns.

shows that migrant networks are positively and significantly related to migration.[2] Furthermore, evidence suggests that migrant networks positively influence the economic returns to migration through higher wages and greater number of hours worked (Donato, Durand and Massey 1992; Massey 1987; Neumann and Massey 1994).

Unlike the other theories of migration, the influence of a cash transfer program on migration that is influenced by migrant networks is not straightforward. As noted, transfers change a household's income level and thereby may influence both the returns to migration and the relative position of households at the point of origin. It should not, however, at least at its initiation, influence the household's access to migrant networks and the corresponding influence of these networks. Rather, it is more likely that community networks may mediate the effect of transfers on migration. We aim to examine whether or not transfer effects on migration are conditioned by the strength of family and community migration networks. Following Winters et al. (2001), we hypothesize that the migration behavior of individuals living in communities with stronger migration networks will be less sensitive to changes in income than individuals living in communities with weak migration networks.

The theories of migration noted here each point to a reduction of migration by poor recipients of government cash transfers with the caveat that this impact may be lessened or raised in the presence of well-established migrant networks. The mechanism by which this occurs differs. The neoclassical model highlights the importance of income levels and the new economics of migration income risk in the presence of market failure. These direct effects are contrasted with the indirect effects which emphasize the effects of transfer programs on relative deprivation. Below we explore these effects.

[2] See for example (Davis, Stecklov and Winters 2002; Davis and Winters 2001; Espinosa and Massey 1999; Massey and Espinosa 1997; Massey and Garcia Espana 1987; Munshi 2003; Taylor 1986; Winters, de Janvry and Sadoulet 2001)

III. PROGRESA and the PROGRESA data

A. PROGRESA

PROGRESA was initiated in Mexico in 1997 as a mechanism for addressing extreme poverty in rural areas. A central feature of the PROGRESA program is the development of human capital of poor households by improving education, health and nutrition outcomes. Therefore, two different forms of cash transfers were provided to households: a food grant and a school scholarship. Each component is linked to separate and independent conditionality requirements. The food grant, which is the same amount for each beneficiary household (US$16 per month as of 2001), is conditional on health check-ups for all family members and attendance by all household adults at public health lectures. Repeated absences by any household member would result in the loss of this transfer. The school scholarships on the other hand are linked to specific children and thus differ by household. If a particular child does not attend school, then the amount of the scholarship amount linked to that child is deducted from the bimonthly payment. For girls in the first year of secondary school the 2002 monthly payment was US$31 per month. To help achieve the stated objectives, transfers with rare exception are provided directly to mothers under the assumption they are more likely to use funds in a manner that will be beneficial to the development of their children.

Because PROGRESA targets poor households, criteria were developed for determining eligibility based on household well-being. This selection of eligible households was done in three stages (see Skoufias, et al (2001)). First, potential recipient communities were identified as poor based on an index of marginality developed from the national population census using community data including the share of illiterate adults, access to water, drainage and electricity, number of occupants per room, dwellings with a dirt floor and population working in the primary sector. More marginal communities were considered potential target locations and were further evaluated based on location and existence of health and school facilities. After communities were identified, the second step was to select households for participation in PROGRESA based on data collected from a household census within the community. Scores were produced for each household using discriminant analysis and households above a certain line were included as beneficiaries. The third step was to present a list of these households to the community assemblies for review and discussion, though in practice these lists were rarely modified.

By the end of 1999, the year corresponding to the data in our sample, PROGRESA provided bimonthly transfers to approximately 2.6 million households or about 40 percent of all rural families and 11 percent of all Mexican families. With the advent of the Fox Administration in 2001, PROGRESA changed its name to OPORTUNIDADES and expanded operations to urban and semi-urban areas (into communities with a population of over 2 500 inhabitants). The PROGRESA budget for 2002 reached US$1.9 billion, covering almost three million rural families and over 1.2 million urban and semi-urban families (Fox 2002; Skoufias and McClafferty 2001). Because PROGRESA conditions payment of transfers on school attendance and visits to health care facilities, it was expected and has been shown that the program had a significant impact on education attendance and health outcomes (Skoufias and McClafferty 2001).

B. The PROGRESA data

We use two primary sources of data for our empirical analysis. The first source of data is the census (ENCASEH) conducted in October 1997 in all communities selected for participation in PROGRESA and which formed the basis for the selection of beneficiary households. Since it covered all PROGRESA communities, including those households surveyed for the PROGRESA evaluation, the census serves as a baseline survey for this study.[3] Second, as

[3] A baseline household survey (ENCEL98M) was carried out in both the treatment and control communities in March, 1998, prior to the initiation of PROGRESA payments in May,

part of an evaluation based on an experimental design, 506 PROGRESA communities in seven regions[4] were selected and randomly allocated into treatment and control groups. Only households in the treatment communities received PROGRESA for the duration of the evaluation. The random assignment of localities allows for a more rigorous evaluation of PROGRESA and ensures that there is only a limited probability that differences between treatment and control groups are due to unobserved factors (Behrman and Todd 1999). As part of this evaluation, follow-up surveys (ENCELs) were conducted every six months in these selected communities for approximately three years. Our analysis utilizes the March 1998, October 1998 and November 1999 data as appropriate.

The ENCEL surveys collected data on all households in the 506 communities, both treatment and control, numbering over 24,000 households in total. We focus our attention on families originally classified as poor (that is, as potential PROGRESA beneficiaries). Initially, PROGRESA classified as eligible about 52 percent of households. Afterward, due to perceived bias against certain kinds of poor households (especially elderly with no children), criteria of eligibility were revised and the program was extended to cover 78 percent of households. This expansion is known as "densification". Because of the revision of the criteria of eligibility, households included in the second phase have different characteristics. As these households were declared eligible later, most of them started receiving cash transfers some time after the initial households, so that the impact of PROGRESA on their consumption could be different. Hence, we restrict our analysis to the "pre-densification" poor (12,627 households).

1998. This first ENCEL did not collect demographic, labor use, and asset information available in ENCASEH, and instead focused on household consumption. We thus use ENCASEH as the main source for control variables.

[4] The regional groupings included Sierra Negra-Zongolica-Mazateca, Sierra Norte-Otomí Tepehua, Sierra Gorda, Montaña, Huasteca, Tierra Caliente and Altiplano, covering parts of the States of Puebla, San Luis Potosi, Queretero, Guerrero, Hidalgo, Michoacan and Veracruz.)

The primary advantage of our data is that the treated households are randomly assigned. However, migration events, our primary interest, constitute a major undertaking for a given household and our reference period is limited to migration reported from the initiation of the program in March 1998 to the November 1999 survey. The implication is that the migration incidence will be relatively low but nonetheless sufficient to identify important behavioral effects.

IV. Empirical specification and results

A. Empirical specification

The first step in the analysis is to determine whether the PROGRESA program influences migration behavior. The experimental design of the data allows us to evaluate the total impact of PROGRESA on migration. Our analysis only includes the households that are eligible for PROGRESA. This means that – aside from random variation – households in the treatment and control communities should be the same in terms of observable and unobservable characteristics. Nevertheless, earlier analyses comparing the control and treatment groups in terms of means suggest that there are some significant differences between treatment and control households (Behrman and Todd 1999). While these differences may be due to chance alone, we use two strategies to further control for remaining observed and unobserved differences. The first is to include a series of household characteristics in the analysis to directly control for household differences. The second, and more robust strategy, is to account for differences between households in the control and treatment communities at the onset of the PROGRESA program by using a difference-in-difference estimator (Heckman, Lalonde and Smith 1999).

Our hypotheses are explored using one of three model specifications: a baseline (BL) specification for capturing the overall effect of PROGRESA, the relative deprivation (RD) specification which allows us to test whether the PROGRESA effect operates indirectly through income distribution, and finally the migration network (MN) specification which tests whether the effect of PROGRESA depends on the existing structure of family and community migration networks.

Our primary goal is to determine whether PROGRESA transfers affect migration behavior, either domestically or to the US. Therefore, the migration outcome variable in these analyses takes on one of three possible values: no migration by any member of the household (0); migration by at least one household member within Mexico but no international migration by any household members (1); and migration by at least one household member to the US (2). Given that households make a choice from a set of three unordered options, the multinomial logit regression model is the most suitable tool for this analysis.

The control variables in all the specifications include a vector of individual and household variables (education, age of household head, gender of household head, etc.) that control for different prospects at the destination points in terms of potential migration as well as any remaining differences between households prior to the onset of PROGRESA. We would like to include a variable to measure income at the point of origin but given the variation in income data from year to year we use expenditure per capita which is considered a better measure of permanent income (Deaton 1992, 1998). We also include measures of risk at the point of origin. Households with assets are more likely to be able to manage risk and we introduce household access to land (both irrigated and non-irrigated) to proxy for risk exposure.

Given the quasi-experimental nature of the PROGRESA program design, there are two possible approaches to undertaking this evaluation. The simpler approach involves the basic Cross-Sectional (CS) estimator as in the following model:

$$Y_i = \text{logit}(M_i) = b_0 + b_1 * P_i + c * Z_i + e_i \qquad \text{(CS-BL)}$$

where:

M_i = 0 if no migration by household *i* between March 1998 (the initiation of PROGRESA) and November 1999; =1 if migrated within Mexico; and, =2 if migrated to the United States

P_i = 1 if household *i* received PROGRESA treatment and 0 otherwise;

Z_i = vector of exogenous control variables and;

e_i = random disturbances.

The effect of PROGRESA is then captured by the P_i variable.

While the cross-sectional estimator is the simpler approach to evaluating the effect of a randomly assigned experiment and easier to interpret, the difference-in-difference (DD) estimator is preferred in that it accounts for variation in the levels of the outcome or explanatory variables at the onset of the experiment (Heckman et al. 1999). Even when the differences between treatment and control groups are due to random sampling, the DD estimator has the advantage of minimizing the effects of this random sampling error. However, in conditions where the control and treatment households may be different for reasons that are likely beyond sampling effects, the DD estimator can also enable us to minimize additional bias. These clear advantages weigh favorably for our use of the DD estimator, but it should be recognized that this estimator introduces some additional complexity into the interpretation of the coefficients, particularly for more complex hypotheses, as will be discussed below. For this reason, we report and discuss both sets of results.

The DD estimator for determining the effect of PROGRESA on migration requires that we redefine our migration outcome in terms of two separate points in time rather than a single interval between the initiation of PROGRESA and the time of the survey as in the CS model. This is easily done given that the survey included questions about household member migration in the years preceding the initial census in 1997 and in each subsequent round. We thus constructed a measure of migration, $M_{i,0}$, for the period preceding the initiation of

PROGRESA (1992 to 1997) using the same criteria from above: no migration, domestic migration, or international migration. $M_{i,1}$ refers to the migration outcome for household *i* between the period following the initiation of PROGRESA (March 1998 and October 1999). Since we are differencing the migration experience for treatment and control households over time, there is no need that the measures be identical over time – only that they are identical at each point in time for treatment and control households – but note that this will affect the interpretation of the coefficient on time, *t*. We are left with the following difference-in-difference baseline specification (DD-BL),

$$Y_{i,t} = \text{Logit}(M_{i,t}) = b0 + b1 * t + b2 * P_i + b3 * t{*}P_i + c * Z_i + e \qquad \text{(DD-BL)}$$

where:

$M_{i,t}$ = 0 if no migration by household *i* in period *t*; =1 if migrated within Mexico in period *t*; and, =2 if migrated to the United States in period *t*.
t = 0 before PROGRESA (before March 1998) and t=1 afterwards (through November 1999).
P_i = 1 if household *i* received PROGRESA treatment and 0 otherwise;
$t{*}P_i$ = interaction of time and PROGRESA treatment;
Z_i = vector of exogenous control variables and;
e_i = random disturbances
In this case, there are 2 observations per household – one for each period – rather than one as in the CS model.

Following from DD-BL, four possible variations of time and PROGRESA can be constructed:

$$
\begin{aligned}
Y(t=1, P=1) &= b0 + b1 + b2 + b3 + c{*}Z \\
Y(t=0, P=1) &= b0 \qquad + b2 \qquad + c{*}Z \\
Y(t=1, P=0) &= b0 + b1 \qquad\qquad + c{*}Z \\
Y(t=0, P=0) &= b0 \qquad\qquad\qquad + c{*}Z
\end{aligned}
$$

Using this information, the before and after difference estimate for PROGRESA communities is,

$$Y (t=1, P=1) - Y (t=0, P=1) = b1 + b3$$

and the before and after difference estimate for non-PROGRESA communities is,

$$Y (t=1, P=0) - Y (t=0, P=0) = b1$$

while the cross sectional difference estimator is simply

$$Y (t=1, P=1) - Y (t=1, P=0) = b2+b3.$$

Subtracting the change in the treatment households (before and after difference estimate for PROGRESA) minus change in control households (before and after difference estimate for non-PROGRESA), we obtain the DD estimator:

$$[Y (t=1, P=1) - Y (t=0, P=1)] – [Y (t=1, P=0) - Y (t=0, P=0)] = b3$$

Thus, the DD estimate of the effect of PROGRESA on migration is the test of the hypothesis that b3=0 ((Heckman et al. 1999; Skoufias 2001; Skoufias and McClafferty 2001).

Including Relative Deprivation

The next two specifications build on the baseline specification and are aimed at capturing the indirect effect of PROGRESA acting through changes in the degree of relative deprivation due to public transfers and effects of social networks in moderating the effect of changing income. These models are easily testable using the CS estimators but we focus on the DD estimators of these specifications for the reasons explained earlier.

We begin with developing a specification that includes RD. As noted in section II, our aim is to determine whether part of the total effect of PROGRESA on migration may be through PROGRESA’s effect on relative deprivation levels. Before proceeding note, however, that including RD in our econometric specification is complicated by the potential endogeneity of the variable. The endogeneity problem is due to the fact it is difficult to determine whether migration is a function of RD or that RD changes as a result of migration. One possible approach for treating this issue with the use of cross-sectional data is the use of standard instrumental variable approach (Stark and Taylor 1989). The experimental design of the

PROGRESA data allows us to employ a simpler approach which takes advantage of this design and the fact we have data from two points in time as opposed to a single point in time. This approach is described below.

Following Stark and Yitzhaki (1982) and Stark and Taylor (1989) relative deprivation, $RD_{i,0}$, is measured by the product of the mean excess consumption of households richer than household *i* and the proportion of households in the community that are richer than household *i*:

$$RD_{i,0} = \left(\frac{\sum_{j=1}^{N} \left[\max\left(0, \left(y_{j,0} - y_{i,0}\right)\right) \right]}{N} \right)$$

where $i,j=1 \ldots N$ and N is the number of households in the community

$y_{i,0}$ = income of household *i* at time 0 (the household of interest)

$y_{j,0}$ = income of household *j* at time 0 .

This calculation can be used to determine the level of relative deprivation prior to the initiation of PROGRESA. To measure the effect of PROGRESA transfers on relative deprivation, we want to measure how PROGRESA changes relative deprivation within the community and thus calculate the following:

$$CHRD_i = RD_{i,1} - RD_{i,0}$$

The $CHRD_i$ variable captures changes in relative deprivation for household *i* in the period after the initiation of PROGRESA. If there were no factors other than PROGRESA that caused changes in relative deprivation during this period, this variable would be sufficient to measure the indirect effects of PROGRESA. However, during this period other factors might also contribute to changes in relative deprivation that are unrelated to PROGRESA. This suggests that the difference in relative deprivation measure, $CHRD_i$, may not be entirely a function of changes due to PROGRESA. Therefore, $CHRD_i$, must be separated into two separate components: PROGRESA-induced changes in RD and non-PROGRESA-induced changes in RD. Because of the experimental design of the data, it is possible to distinguish PROGRESA and non-PROGRESA related changes to RD by including an interaction term between $CHRD_i$ and PROGRESA. The $CHRD_i$ identifies the effects of changes in relative deprivation for the overall sample while the interaction term identifies how those changes differ for PROGRESA households. The specification is as follows.

$$\text{Logit}(M_i) = b_0 + b_1 * P_i + b_2 * RD_{i,0} + b_3 * CHRD_i + b_4 * P_i * CHRD_i + c * Z_i + e_i \quad \text{(CS-RD)}$$

The coefficient on the $CHRD_i$ variable, b_3 , represents the change in relative deprivation that *is not* associated with PROGRESA transfers while the b_4 coefficient on the interaction captures the change in relative deprivation that *is* associated with PROGRESA transfers. The total effect of PROGRESA is captured through both b_1, the direct effect, and b_4, the indirect effect.

For reasons noted above, the CS model does not eliminate all potential bias in the experimental design and thus the DD estimator is preferred. Including RD in the DD model poses a similar challenge as with the CS model. That is, we need to specify the model in a way that isolates the non-PROGRESA and PROGRESA induced changes in RD. By design, the DD model includes changes that occur over time – through the time dummy – as well as controlling for difference between the control and treatment households – though the PROGRESA dummy. These allow for the identification of the program effects through the interaction of the two dummy variables. This design allows us to identify the indirect effects of relative deprivation through the interaction of the RD variable with each of the dummies as follows:

$$\text{logit}(M_{i,t}) = b_0 + b_1*t + b_2*P_i + b_3*t*P_i + b_4*RD_{i,t} + b_5*P_i*RD_{i,t} + b_6*t*RD_{i,t} + b_7*t*P_i*RD + c*Z_i + e_i \quad \text{(DD-RD)}$$

The coefficient b_5 controls for any difference in RD across the PROGRESA and non-PROGRESA households while b_6 controls for any changes in RD that occurred over time independent of PROGRESA. As before, PROGRESA's effect on migration is identified through the coefficient b_3, but now a portion of PROGRESA's impact that operates through its effect on RD. Manipulating this equation to identify the DD estimator in a manner similar to that done above allows the determination of the total PROGRESA effect which is $b_3 + b_7*RD_{i,1} + b_5*(RD_{i,1} - RD_{i,0})$. This shows that PROGRESA has a direct effect on migration through the coefficient b_3 and an indirect effect on migration through the rest of the equation: this includes the effect through RD, b_7, net of any initial differences that existed between PROGRESA and non-PROGRESA households (b_5).

Including networks

Our final specification focuses on determining whether the effects of PROGRESA depend on the existing structure of migration networks. We view networks as a form of social capital that is specific to potential migration opportunities. The value of the migration network will tend to vary according to the relation between potential migrants and their network. We introduce separate network terms for networks in the US and networks in Mexico and each of these is further divided into family networks and community networks. Social networks are likely to mediate the effects of public cash transfers on migration. Testing these effects is quite simple using the experimental design of the data. It also enables us to develop some further insight into the role of migration networks that is not normally available from the analysis of traditional survey data.

Family networks are measured by person and are measured as a count of the number of members of the household that are reported to have migrated from the household in the five years prior to PROGRESA – that is, from 1992 to 1997 – either within Mexico (family domestic MN) or internationally (family international MN). Community migration network estimates are calculated as the fraction of individuals in each community, excluding the reporting household, that have migrated to either Mexico or the US between 1992 and 1997 . Household reports on community migration network density from the PROGRESA data indicate that the average household lives in a community where about 3 percent of adults experienced domestic migration and about 1 percent experienced US migration between 1992 and 1997. Note however that this relatively low average disguises considerable variation across communities, with some communities reporting that over half of all adults have migrated to the US between those years and some reporting no migration. While most prior studies are forced to rely on sample estimates to construct the community migration parameters, the PROGRESA study is based on censuses of the selected communities meaning that all households, including those that are not part of the sample used in this analysis, are included in the community migration network variables.

Since we are examining migration from the initiation of PROGRESA through the 1999 survey, we use initial migrant networks in this analysis. Therefore, the migration network variables do not change over the period in question, which simplifies the specification. To identify the importance of networks the four network variables are included directly in the specification and to identify whether these networks influence the PROGRESA effect an interaction term is included. The CS-MN specification is then:

$$\text{logit}(M_i) = b_0 + b_1 * P_i + \sum_{j=2}^{5} b_j * MN_{i,j} + \sum_{k=6}^{9} b_k * P_i * MN_{i,k} + c * Z_i + e_i \qquad \text{(CS-MN)}$$

where b_2-b_5 capture the effects of existing migration structures on domestic and international migration and b_6-b_9 identify whether or not networks influence the effect of PROGRESA and providing a test of the network mediation hypothesis.

Following along similar lines, the DD model can be modified to include migrant networks. As noted, the MN variables do not change over time thus an interaction between MN and the time dummy would be meaningless. Furthermore, we assume that migrant networks do not vary across treatment and control households in any systematic manner since the random assignment at the community level should control for this type of variability. The specification is as follows:

$$\text{logit}(M_{i,t}) = b_0 + b_1 * t + b_2 * P_i + b_3 * t * P_i + \sum_{j=4}^{7} b_j * MN_{i,j} + \sum_{k=8}^{11} b_k * t * P_i * MN_{i,k} + c * Z_i + e_i \qquad \text{(DD-MN)}$$

As with the CS model, this specification allows an evaluation of whether migrant networks modify the influence of PROGRESA. Individual tests of each of the coefficients, b_6-b_9, help determine whether the effect of PROGRESA is mediated by social networks. Joint tests of those coefficients together indicate whether this effect is jointly significant.

B. Results

Tables 1 and 2 present the cross-sectional (CS) and difference-in-difference (DD) specifications, respectively. In each case, Specification 1 refers to the baseline specification. The subsequent specification (Specification 2) in both tables adds relative deprivation (RD) and the last specification (Specification 3) in each table examines the role of social networks. The results in both tables are divided in half. The top half includes the control (*Z_i)* variables for our regression models. These are interesting in and of themselves but not the primary focus of our research. The bottom half of each table includes the PROGRESA and PROGRESA-related variables. The estimated standard errors of the coefficients are adjusted using techniques to account for autocorrelation of the error term. For tests of joint significance, Wald tests are used rather than likelihood ratio tests because of the clustering in our data. We present our main results in terms of the coefficient estimates and how they affect the two migration outcomes although it is implicit that all coefficients are actually in terms of the log odds of the specific migration outcome (either domestically or internationally) versus the reference outcome which is "no migration" unless otherwise specified.

Two related issues arise with the use of the multinomial regression model and both concerns are assessed with the cross-sectional model specifications. The first is whether the three outcomes in our model (no migration, domestic migration, international migration) are distinct or whether any two of the outcomes might be aggregated. The possibility of combining outcome categories depends on whether the variables in our model distinguish between these outcomes in a statistical sense or whether a more parsimonious model may provide just as well of a fit. We are particularly concerned by the domestic migration outcome which we believe is important to differentiate for theoretical reasons but which may not in fact be different from the international migration outcome. This possibility is rejected using the Wald test and our decision to treat each of the three outcomes as distinct is supported by the data. The second question raised by the multinomial model is the underlying assumption of the Independence of Irrelevant Alternatives (IIA); that is whether the odds of outcomes in the model do not depend on other available choices. We test the IIA assumption using both the Hausman and the Small-Hsiao tests[5]. The results provide support for our use of the multinomial logit model since neither test rejects the null hypothesis that the IIA assumption holds.

We begin by briefly reviewing the basic results and implications of the control variables in our models (Specification 1 in Tables 1 and 2). While there is some variation in the magnitudes of the coefficients on the control variable estimates between the CS and DD models, they are broadly speaking consistent between the models as well as across the

[5] Our tests are based on the procedures developed by J. Scott Long and Jeremy Freese (2000).

specifications. Therefore, the discussion focuses on the coefficients of the CS model, baseline specification.

The results show that larger household size is associated with greater migration to both domestic and international destinations versus no migration. This effect is strong and highly consistent throughout. In all cases, we find that the effect of household size is stronger on the odds of domestic migration than international migration -- although not significantly so. The effect of household structure is also present through nine separate measures of household composition. The first three variables capture the percentage of the household that is composed of children aged 0-4, 5-9, and 10-14. Interestingly, only the presence of young children (0-4) reduce migration (significantly) and this is only the case for domestic migration. The coefficient on international migration is positive but insignificant and both these results hold in the DD as well as the CS models. While having a higher composition of children 5-9 does not appear to significantly affect migration, we find that children 10-14 seem to play an important role. As the household composition increases in terms of the percent of children 10-14, the odds of either type of migration strongly increases. This effect is significant for domestic migration in both models and is significant for international migration in Table 2. Substantively, increasing the household composition of 10-14 year olds by 10 percent increases the odds of domestic migration versus no migration by 12 percent and the odds of international migration versus none by 33 percent. Unlike older adults, it is likely that children 10-14 are less instrumental as migrants and instead offer alternative labor supply choices for households that lose working age adults to migration.

The effect of working age adults in the household is more complex and variable than expected. We find that both male and female young adults (15-19) are associated with an increase in migration to either destination. Similarly, higher percentages of men and women 35-59 are also associated with higher migration. Both these results are consistent with excess labor supply explanations. However, we find that higher proportions of men and women 20-34, are not unequivocally associated with higher migration. The results is possibly due to reproductive strategies of households who are engaged in family building processes during this age period.

The age of the household head also increases migration to both destinations, although the effects are only significant in the difference-in-difference models (Table 2). While most households are headed by males (92%) in 1997, the data suggest that migration to both destinations is higher when the head is female – most likely signaling that the male head has migrated. These effects are only significant for domestic migration specifications 1-3 in Table 1.

Over 40% of household heads in our sample speak an indigenous language. The impact of this variable, which may serve as a proxy for cultural characteristics as well as structural poverty, suggests opposite effects on domestic and international migration. Households with heads that are indigenous-language speaking experience higher odds of domestic migration and lower odds of US migration less than households with heads that are not indigenous-language speaking. Both effects are highly significant. These results are supported by other empirical analyses of the characteristics of Mexican migration both domestically and internationally (Davis et al. 2002).

Education is measured as the average number of years of schooling for adults in the household. Education provides a good proxy for the potential ability of households to benefit from migration through higher wage offers, though higher levels of education are more likely to be valued domestically then in the US labor market. Education is included as both a linear and quadratic term. We find that the linear coefficient is consistently positive and the quadratic term is consistently negative in all the models. By calculating the predicted probabilities of domestic and US migration at different levels of education, we find that the probability of domestic migration rises and reaches a maximum at about 7 years before beginning to decline at higher levels of education and that this same maximum is reached at around 4 years of education for US migration. This would suggest that education increases migration to both destinations but that the marginal effect is diminishing at higher levels of education. This result supports the notion that the education level of migrants is more important for domestic then international migration. Despite the consistent estimates, the joint test of these relationships is significantly different from 0 only in the domestic migration models (χ^2=10.94 with 10 degrees of freedom).

Household resources, as measured by household expenditures, play an important role in our analysis acting both as proxies for household permanent income and as indirect measures of households' exposure to risk. Surprisingly, the effect of expenditures on migration is somewhat muted with the joint effect of the linear and squared terms only significant at 10% and this only for US migration. Expenditures appear to have a positive and marginally significant but diminishing impact on international migration while their effect on domestic migration is negative and diminishing but insignificant. The result that expenditures have opposing influence on US versus domestic migration is more clearly supported when the model is tested with international migration as the reference category. In this case (not shown) we get a strongly significant difference between domestic and international migration.

Land variables are included to proxy for household asset holdings and a household's ability to weather risk. According to the new economics of migration, we should expect that higher land holdings will reduce migration to both destinations. However, many households in this sample do not have land for agricultural purposes, and those who do on average have lower levels of well being as measured by consumption. It is thus not surprising that the impact of irrigated and non-irrigated land is insignificant for all models in Table 1 and 2.

Impact of PROGRESA

We first turn our focus to estimates of the total effect of PROGRESA on migration. The simpler estimate, based on CS regression (Specification 1 of Table 1), suggests that there is a negative but insignificant effect of PROGRESA on international migration and a slightly positive but insignificant effect on domestic migration. In both cases, the standard errors are far larger than the coefficients and no obvious effect is observable in either case. Substantively, ignoring the issue of statistical significance, these coefficients would imply that PROGRESA increases the odds of domestic migration versus no migration by 2.2% and reduces the odds of US migration by almost 17%.

As noted earlier, we turn to the DD specification to account for potential differences in migration behavior at the onset of the program. We find that the difference-in-difference estimates paint a different picture. First, the coefficients on the PROGRESA variable are positive for both domestic and international migration suggesting slightly higher – although not significantly – migration in PROGRESA households at the outset of the program. Second, the coefficients on the time variable (post) are both significant and positive but this simply allows us to account for the different periods covered by the migration measure before and after PROGRESA. The PROGRESA-Post interaction captures the difference in migration behavior for PROGRESA households before and after the program minus the difference in migration for non-PROGRESA households. By accounting for differences before the onset of the program, we find that PROGRESA does in fact have a significant, albeit marginal (significant at 10%) negative effect on international migration versus no migration. Unlike the result for the CS model, the coefficient on domestic migration is negative, but remains entirely insignificant.

The results indicate that the PROGRESA failed to stem the flow of rural migration to domestic, primarily urban, destinations but did affect the flow of migrants to international destinations. Furthermore, the size of the coefficient on PROGRESA in the international migration models indicates a substantial quantitative impact. The results suggest that PROGRESA, after only 18 months of operation, reduces the odds of international migration by almost 40%. This implies that cash transfers may be an important policy instrument for limiting the flow of rural migrants to international destinations.

The results also call into question the use of cross-sectional analysis to identify the effects of government programs on migration. The cross-sectional analysis fails to adequately control for potential differences in household types (PROGRESA vs. non-PROGRESA) and changes in migration over time independent of program effects.

Impact of relative deprivation

The above analysis (Specification 1) shows the influence of PROGRESA on migration but does not indicate whether this effect comes through the direct provision of cash or through an indirect effect on income inequality within recipient communities. We hypothesized that part of the effect of the PROGRESA transfers program on migration is through its impact on relative deprivation levels. Determining whether relative deprivation influences migration is not only important from a public policy standpoint, but it also has the potential to enhance our understanding of the theoretical importance of relative deprivation in the migration decision.

Table 1 presents the results for the CS model including the variables representing the effects of relative deprivation (Specification 2). While relative deprivation does not appear to have a significant effect on domestic migration, initial relative deprivation and changes in relative deprivation not associated with PROGRESA positively influence international migration. An increase in relative deprivation or increases in relative deprivation over time appear to increase the odds of international migration (significantly). The more relevant coefficient is the interaction between PROGRESA and RD which is negative but which we find is not significant. Nevertheless, the joint effect of all three coefficients on US migration is highly significant (χ^2=23.4 with 3 degrees of freedom).

We now turn to the DD results of Table 2. As described in the previous section, our estimate of the relative deprivation effect due to PROGRESA involves the inclusion of 4 additional variables into Specification 2 of Table 2. Each of these variables captures a different aspect of relative deprivation effects and together they enable us to obtain a differenced estimate of the effect of relative deprivation on migration, accounting for potential differences between non-PROGRESA and PROGRESA households before and after the program. The multiplicity of coefficients makes the DD tests for relative deprivation effects on migration somewhat more complicated to interpret. Joint tests of the coefficients of the relative deprivation variables (RD, RDxPOST, RDxPROGRESA, and RDxPROGRESAxPOST) across all outcomes suggest that relative deprivation significantly improves model fit (χ^2=36.6 with 18 degrees of freedom). Furthermore, the fit is improved for each of the outcomes separately. We find that the joint test of the four variables is highly significant both for domestic migration versus no migration and for international migration versus no migration. Thus, as we found in the cross sectional analysis, the total effect of relative deprivation apparently plays a role in migration behavior.

The more direct test of our hypothesis regarding whether or not the effect of PROGRESA on migration is through its effect on relative deprivation is based on the test of the interaction term: RDxPROGRESAxPOST. This term is positive for domestic migration and negative for the international migration (both as we found in the CS results of Table 1) yet neither coefficient is significant. Nevertheless, as we would expect if our original hypothesis were true, the measure of PROGRESA's direct effect (PROGRESAxPOST) falls considerably once the RD effects are introduced into the model – at least in the case of international migration – and the significance falls as well. This pattern suggests that multicollinearity problems may be affecting our results. While none of the bivariate correlations are excessively high, our tests for multicollinearity using more sophisticated techniques and measured using the Variance Inflation Factor (VIF) sheds light on the problem as several of our interactions variables show several VIF factors near 10. While there is considerable uncertainty regarding an exact threshold for multicollilnearity diagnosis, such high VIF values may be associated with inflated standard error estimates for regression coefficients (Kennedy 1992). There is no real solution to this problem other than to restrict the variables in our model and any such restrictions would lead to omitted variable bias calling the results into question. The strong role of relative deprivation in these results, combined with the evidence of possible multicollinearity, suggests that relative deprivation may be directly affected by PROGRESA which may influence migration but this result is only tentative.

The overall pattern of evidence suggests cautious support for our hypothesis that part of PROGRESA's effect is explained by changing relative deprivation levels. Our results suggest that PROGRESA's effects on migration of poor households will be to reduce international migration. This process appears to operate through two channels. The first channel is the direct effect of improved resources on household welfare which leads poorer households to reduce their US migration propensities. Secondly, PROGRESA transfers also operate through an indirect route. By shifting the income distribution within PROGRESA communities, PROGRESA recipient households find themselves in a relatively better position. Migration no longer seems as attractive or necessary as before and household migration propensities are again reduced.

Introducing migration networks

The data so far suggest a strong though marginally significant effect of PROGRESA on international migration and very little or no effect on domestic migration. Social networks, however, have yet to be introduced into the analysis.

We first turn to the cross-sectional estimates (Table 1, Specification 3). Our results confirm the relevance of migration networks in the migration process, particularly community networks. The data suggest that domestic migration is positively and significantly influenced by community domestic migration networks and international migration by community international migration networks. The magnitude of the effects is easily quantifiable in terms of odds ratios although one must recall that odds ratios can be quite high for relatively rare events. Community networks are density measures but raising the size of the domestic community migration network from the mean value of three percent to 4 percent will change the odds of domestic migration versus no migration by a factor of almost 10 percent. Similarly, an increase in the density of international community networks from the mean of one percent to 2 percent raises the odds of international migration versus no migration by a factor of almost 8 percent.

These general migration network effects are interesting and support previous research on migration networks in Mexico (Davis et al. 2002; Winters et al. 2001), but our focus is on the interaction between migration networks and PROGRESA transfers (PROGRESA x Networks). As noted in the above section, we expect that transfers will likely be less effective where existing migration networks (both family and community) are stronger. While PROGRESA's direct effect was already shown to be negative and significant for international migration and positive but insignificant for domestic migration, the picture is considerably more complicated once the interactions are included. Surprisingly, PROGRESA's negative effect on US migration appears strengthened (becoming more negative) in communities with strong community US migration networks. The implication is that PROGRESA transfers reduce migration to the US more in communities where strong US community migration networks exist than in a community with weaker networks. This runs contrary to the hypothesis argued earlier that PROGRESA may be less effective in deterring migration in communities with well established networks.

The results for the DD model are presented in Table 2-Specification 3 where the four migration network variables are included along with their interactions with the PROGRESA and post variables. Not unexpectedly, the results come out rather similar to the cross-sectional results. As opposed to Specification 2, the test for the effects of migration networks makes less use of the difference-in-difference framework because only one measure is made of the migration networks (at the program onset). Thus, there is no attempt to create a measure of the change in migration networks over time -- a measure that would likely be endogenous to the program design if individuals return to the communities where transfers are provided by the government.

The results suggest that migrant networks play a stronger role in the migration decision – as was indicated in the CS model. First, family domestic and international networks are found to positively and significantly influence, respectively, domestic and international migration. As with the CS model, community domestic and international networks positively and significantly influence migration to their respective locations. The results also indicate that community domestic networks negatively affect international migration while community international networks similarly affect domestic migration. Finally, the results confirm the CS results that PROGRESA transfers reduce migration to the US more in communities where strong US community migration networks exist than in a community with weaker networks.

Quantitatively, we can compare the effect of PROGRESA in communities with relatively small community migration density levels to the effect in communities with relatively large levels. As before, we compare international migration for households in weak and strong international migration networks. The results have already shown that PROGRESA reduces the odds of international migration by about 40%. The effect of networks is now more complicated to assess and is best viewed with the help of a graph. Figure 1 highlights the magnitude of the effect of PROGRESA on international migration behavior and the role of international community migration networks. The figure is based on the predicted change in probability of US migration for PROGRESA and non-PROGRESA households between 1998 and 1999. The outcome that is plotted then shows how PROGRESA changes US migration over time. This value is shown at various density levels of US community migration networks. We see that at low network density levels, PROGRESA reduces migration but the effect is relatively small. The predicted probability of US migration for households in this case is reduced by less than 1 percentage point. However, at higher levels of network density the migration reducing effect of PROGRESA becomes rather more substantial and is associated with reducing the probability of US migration by 5 percentage points or more.

[[Figure 1 about here]]

VI. Conclusions

Can public transfer programs reduce migration? Nowhere is this question more pertinent than in the case of Mexico. Mexican concerns focus on both domestic and international migration. Domestic migration is important because of the relevance of internal population mobility for community development, urbanization, and urban squalor. International migration is important due to the well-publicized and controversial migration streams that flow back and forth between Mexico and the US. These international flows are both an important source of income for many Mexicans and for the country as a whole, but they also carry with them costly tensions in terms of relations with the US, as well as social costs for Mexican families and their communities of origin.

In this paper, we make use of a large-scale experimentally designed evaluation of the PROGRESA project to examine the effect of changes in household resources, relative deprivation, and networks on domestic and US migration outcomes. These are not new questions – they have been explored extensively in prior research (Massey and Espinosa 1997; Palloni et al. 2001; Stark and Taylor 1989; Winters et al. 2001). However, we are unfamiliar with any previous studies that make use of experimental design data to examine the determinants of migration outcomes. Given the inherent difficulty in achieving causal validity in social research and in migration research in particular, our approach and results offer a new and innovative approach to assess the determinants of migration.

Our results both support existing lines of understanding as well as raise some new questions. We find that increasing household income through publicly provided cash transfers reduces migration. The results are not surprising although the magnitude of the effect is quite substantial. Existing research continues to branch out and investigate non-economic motivation that underlie migration yet it is useful to remember that economic forces matter. It is important to understand that even in situations where a "culture of migration" may be deeply rooted (Kandel and Massey 2002), households will change their behavior in the face of changing economic conditions. Changing household income apparently induces a direct effect whereby household migration incentives decline – at least as far as US migration is concerned.

We also examined the possibility that changes in the income distribution within a community will itself lead to changes in migration incentives, regardless of whether absolute income stays the same or not (Stark and Taylor 1987, 1989; Taylor 1986). Our findings provide some support for the hypothesis that income changes do indeed have indirect as well as direct effects. Relatively deprived households are more likely to migrate to the US than less relatively deprived households. We find that the PROGRESA transfers appear to lead to a reduction in the relative deprivation of poor households and thus to a decline in their migration incentives. However, this last result is not statistically significant and there is some evidence that this is due to multicollinearity.

Our results also offer further reinforcement for the importance of migration networks on migration outcomes. We find that households with strong migration networks to the US are much more likely to send migrants to the US and households with strong migration networks within Mexico will more likely migrate within Mexico. These results support previous studies (Massey et al. 1994a). We were not surprised by the fact that the effect of changing income varies by migration network structure but we had anticipated the result to be in the opposite direction. What we have found is that income transfers for households in communities with strong U.S.-based migration networks reduce U.S. migration even more than for households in communities with weak migration networks. This effect is only significant for domestic migration.

The policy implications that emerge from these results are quite intriguing and worthy of investigation. Our findings suggest that rural out-migration to international destinations can be reduced by government poverty programs such as the PROGRESA cash transfer program. This is true even in communities with relatively greater density of migration networks, where in fact, surprisingly, we find that PROGRESA had a greater impact in stemming migration. Obviously, these high-migration communities are the main sources for migration flows but we expected that transfers would have little influence in such communities where migration patterns are already well-established. Furthermore, we find that, while relative income matters in the migration decision, the PROGRESA effect appears to be primarily driven by the effect on absolute income. This implies that cash transfer programs should focus on the absolute level of cash transfer provided rather than how the transfer might alter inequality in the community.

Figure 1: Probability of US migration Differences due to PROGRESA at various US Community Migration Density Levels

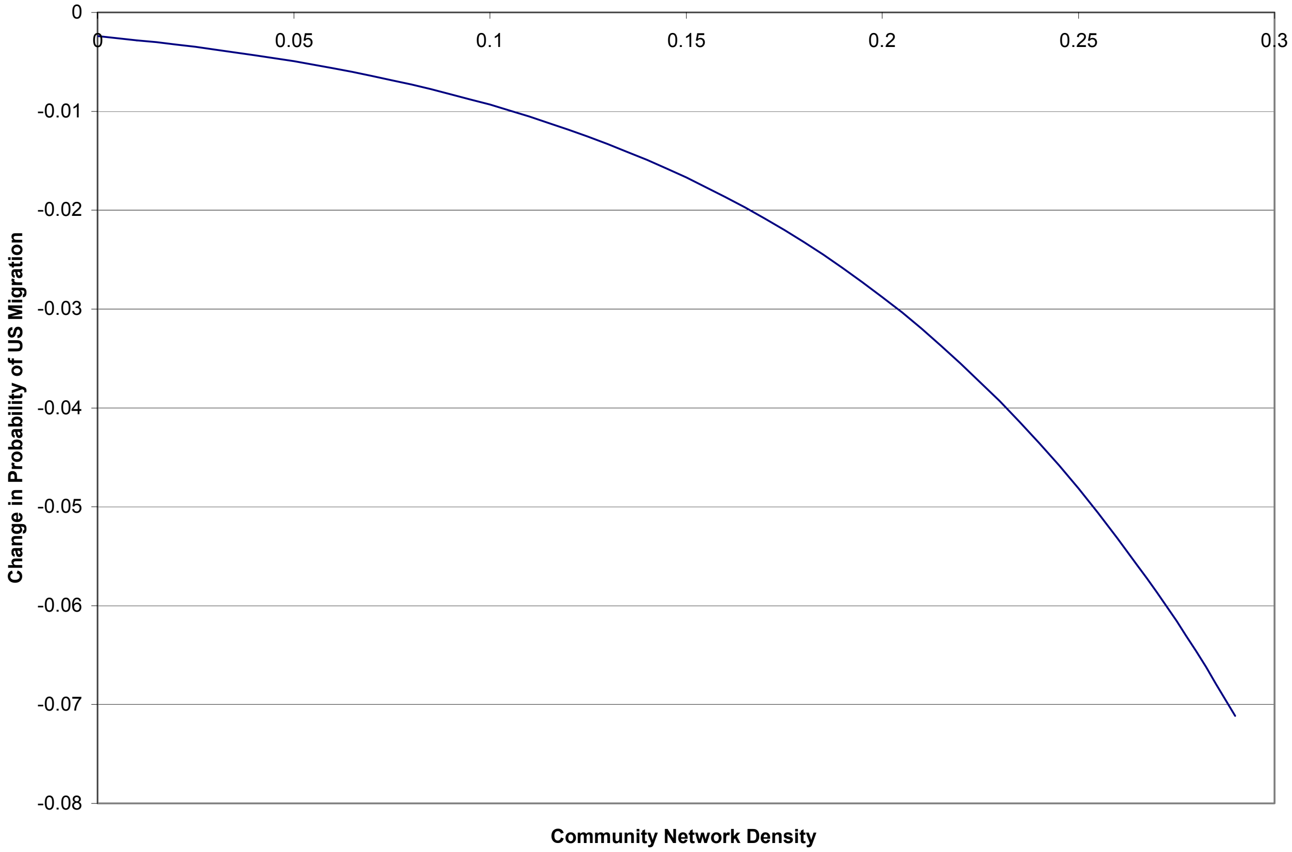

Table 1: Results for Cross-Sectional Model

	Specification 1		Specification 2		Specification 3	
	Dom Mig	Intl. Mig	Dom Mig	Intl. Mig	Dom Mig	Intl. Mig
Household Size 97	0.235***	0.224***	0.241***	0.199***	0.244***	0.235***
	[8.772]	[5.439]	[8.655]	[4.875]	[8.819]	[5.427]
Children 0-4 as % of household (97)	-2.773***	2.203	-2.821***	2.122	-2.668***	1.981
	[3.107]	[0.802]	[3.170]	[0.765]	[2.962]	[0.718]
Children 5-9 as % of household (97)	0.218	2.450	0.220	2.206	0.473	1.964
	[0.276]	[0.889]	[0.280]	[0.793]	[0.605]	[0.715]
Children 10-14 as % of household (97)	1.671**	4.123	1.700**	3.802	1.762**	3.610
	[2.304]	[1.540]	[2.351]	[1.407]	[2.416]	[1.320]
Males 15-19 as % of household (97)	2.272***	5.993**	2.278***	5.561**	2.485***	5.888**
	[2.896]	[2.189]	[2.927]	[2.016]	[3.045]	[2.172]
Females 15-19 as % of household (97)	2.747***	3.598	2.752***	3.229	3.047***	3.075
	[3.450]	[1.248]	[3.479]	[1.108]	[3.783]	[1.099]
Males 20-34 as % of household (97)	0.722	3.856	0.698	3.809	0.874	3.998
	[0.775]	[1.353]	[0.750]	[1.330]	[0.918]	[1.384]
Females 20-34 as % of household (97)	-0.304	3.101	-0.316	3.114	-0.044	2.815
	[0.318]	[1.007]	[0.330]	[1.001]	[0.045]	[0.966]
Males 35-59 as % of household (97)	2.142***	1.988	2.100***	2.170	2.199***	2.214
	[2.937]	[0.865]	[2.873]	[0.937]	[2.911]	[0.963]
Females 35-59 as % of household (97)	2.598***	5.365*	2.559***	5.577*	2.510***	4.989
	[3.292]	[1.668]	[3.228]	[1.695]	[3.153]	[1.562]
Head's Age 97	0.009	0.020	0.009	0.018	0.009	0.016
	[1.331]	[1.598]	[1.355]	[1.421]	[1.373]	[1.188]
Male head 97	-0.618***	-0.491	-0.631***	-0.475	-0.658***	-0.496
	[3.105]	[1.467]	[3.168]	[1.471]	[3.234]	[1.452]
Indigenous Household	0.402**	-1.547***	0.353**	-1.325***	0.276*	-1.268***
	[2.542]	[3.772]	[2.118]	[3.220]	[1.806]	[3.080]
Mean adult Education (years)	0.278***	0.268	0.279***	0.271	0.215**	0.301
	[2.622]	[1.512]	[2.632]	[1.534]	[2.161]	[1.572]
Mean adult Education (years)Squared	-0.019*	-0.030	-0.019*	-0.030	-0.014	-0.033
	[1.717]	[1.351]	[1.709]	[1.367]	[1.337]	[1.423]
Household Expenditures (March 98)	-0.001	0.004**	-0.002	0.005***	-0.001	0.005**
	[1.526]	[2.179]	[1.563]	[2.595]	[1.590]	[2.142]
Household Expenditures (March 98) Squared	0.000	0.000	0.000	-0.000**	0.000	0.000
	[1.145]	[1.613]	[1.446]	[1.970]	[1.198]	[1.589]
Irrigated Land (Oct 98)	0.065	0.064	0.071	0.029	0.037	0.069

	[1.159]	[0.886]	[1.293]	[0.330]	[0.622]	[0.933]
Non-irrigated Land (Oct 98)	-0.003	0.002	-0.003	0.003	-0.009	0.000
	[0.151]	[0.075]	[0.176]	[0.114]	[0.448]	[0.009]
Progresa	0.022	-0.184	0.090	-0.369	-0.077	-0.258
	[0.133]	[0.616]	[0.473]	[1.305]	[0.349]	[0.556]
RD (Oct 98)			-0.002	0.010***		
			[1.025]	[4.389]		
RD change			-0.002	0.010***		
			[0.839]	[2.940]		
Progresa x RD change			0.002	-0.004		
			[0.732]	[1.358]		
Family-based Domestic Migration Network					-0.040	-0.058
					[0.227]	[0.149]
Family-based Intl. Migration Network					-0.879	0.114
					[0.994]	[0.203]
Community Domestic Migration Network					8.324***	-5.662
					[3.624]	[0.633]
Community Intl. Migration Network					-8.608	22.402***
					[1.057]	[4.020]
Progresa x Family Domestic Migration Network					0.114	0.538
					[0.508]	[1.207]
Progresa x Family Intl. Migration Network					0.925	0.298
					[0.980]	[0.521]
Progresa x Community Domestic Migration Network					2.069	5.297
					[0.513]	[0.538]
Progresa x Community Intl. Migration Network					-2.456	-15.785**
					[0.274]	[2.558]
Constant	-6.138***	-10.194***	-5.953***	-10.627***	-6.328***	-10.120***
	[7.377]	[3.164]	[6.808]	[3.267]	[7.333]	[3.341]
Observations	9722		9722		9722	
Log Likelihood	-1898.3		-1885.5		-1844.9	

Robust z statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 2: Results for Difference-in-Difference Model

	Specification 1		Specification 2		Specification 3	
	Dom Mig	Intl. Mig	Dom Mig	Intl. Mig	Dom Mig	Intl. Mig
Household Size 97	0.164***	0.128***	0.168***	0.111***	0.171***	0.127***
	[7.510]	[3.836]	[7.575]	[3.339]	[7.761]	[3.608]
Children 0-4 as % of household (97)	-1.642**	1.645	-1.668**	1.572	-1.519**	1.824
	[2.392]	[1.492]	[2.432]	[1.430]	[2.211]	[1.635]
Children 5-9 as % of household (97)	0.046	1.783*	0.060	1.615	0.196	1.456
	[0.081]	[1.654]	[0.105]	[1.503]	[0.341]	[1.344]
Children 10-14 as % of household (97)	1.134**	2.845***	1.156**	2.649***	1.161**	2.453**
	[2.058]	[2.792]	[2.103]	[2.609]	[2.111]	[2.308]
Males 15-19 as % of household (97)	1.189*	3.499***	1.213*	3.303***	1.299**	3.431***
	[1.900]	[3.137]	[1.940]	[2.988]	[2.025]	[3.042]
Females 15-19 as % of household (97)	1.459**	2.699**	1.469**	2.503**	1.639***	2.041*
	[2.370]	[2.304]	[2.388]	[2.129]	[2.606]	[1.668]
Males 20-34 as % of household (97)	-0.373	-0.679	-0.383	-0.695	-0.299	-0.628
	[0.510]	[0.513]	[0.524]	[0.527]	[0.406]	[0.461]
Females 20-34 as % of household (97)	-1.439*	2.681**	-1.446*	2.642**	-1.319	2.718**
	[1.796]	[2.114]	[1.798]	[2.072]	[1.626]	[2.179]
Males 35-59 as % of household (97)	0.965*	0.419	0.959*	0.444	0.957	0.673
	[1.684]	[0.385]	[1.668]	[0.411]	[1.640]	[0.612]
Females 35-59 as % of household (97)	2.440***	4.144***	2.410***	4.214***	2.256***	4.157***
	[4.097]	[3.465]	[4.045]	[3.472]	[3.730]	[3.635]
Head's Age 97	0.017***	0.033***	0.017***	0.031***	0.017***	0.030***
	[3.333]	[4.378]	[3.319]	[4.183]	[3.112]	[3.839]
Male head 97	-0.483***	-0.538**	-0.494***	-0.521**	-0.520***	-0.489**
	[2.940]	[2.338]	[2.999]	[2.284]	[3.142]	[2.058]
Indigenous Household	0.385***	-2.011***	0.355***	-1.870***	0.271***	-1.761***
	[4.163]	[8.004]	[3.755]	[7.463]	[2.791]	[6.936]
Mean adult Education (years)	0.260***	0.212	0.258***	0.210	0.194**	0.278**
	[3.300]	[1.630]	[3.288]	[1.633]	[2.474]	[2.004]
Mean adult Education (years)Squared	-0.020**	-0.026	-0.020**	-0.026*	-0.015	-0.032*
	[2.223]	[1.643]	[2.227]	[1.647]	[1.614]	[1.915]
Household Expenditures (March 98)	-0.001	0.002**	-0.001*	0.003***	-0.001	0.001
	[1.122]	[2.205]	[1.877]	[2.874]	[0.836]	[1.527]

Household Expenditures (March 98) Squared	0.000	0.000	0.000	0.000	0	0
	[0.548]	[1.035]	[1.322]	[1.304]	[0.305]	[0.801]
Irrigated Land (Oct 98)	0.032	-0.039	0.037	-0.056	0.013	-0.034
	[0.549]	[0.419]	[0.652]	[0.571]	[0.245]	[0.341]
Non-irrigated Land (Oct 98)	-0.016	0.018	-0.016	0.018	-0.023	0.017
	[0.919]	[1.379]	[0.909]	[1.408]	[1.334]	[1.088]
Progresa	0.102	0.350	0.427	0.413	0.097	0.121
	[0.609]	[1.628]	[1.274]	[1.130]	[0.576]	[0.532]
Post	0.933***	0.377*	0.539*	-0.055	0.941***	0.376
	[5.925]	[1.645]	[1.776]	[0.122]	[5.928]	[1.632]
Progresa x Post	-0.060	-0.502*	-0.140	-0.311	-0.117	-0.527
	[0.303]	[1.723]	[0.357]	[0.587]	[0.534]	[1.558]
RD			-0.003	0.004		
			[1.072]	[1.473]		
RD x Post			0.005	0.007*		
			[1.546]	[1.772]		
RD x Progresa			-0.004	-0.001		
			[1.089]	[0.323]		
RD x Progresa x Post			0.000	-0.003		
			[0.086]	[0.537]		
Family-based Domestic Migration Network					0.331***	0.188
					[3.192]	[0.891]
Family-based Intl. Migration Network					-0.272	0.633***
					[0.541]	[3.239]
Community Domestic Migration Network					7.525***	-7.609*
					[5.335]	[1.913]
Community Intl. Migration Network					-9.388**	9.875***
					[2.267]	[5.281]
Progresa x Post x Family Dom. Mig. Network					-0.212	0.264
					[1.295]	[0.881]
Progresa x Post x Family Intl. Mig. Network					0.389	-0.228
					[0.989]	[0.877]
Progresa x Post x Comm. Dom. Mig. Network					2.492	6.899
					[1.210]	[1.328]
Progresa x Post x Comm. Intl. Mig. Network					-1.612	-4.289**
					[0.292]	[1.974]

Constant	-6.596***	-8.796***	-6.293***	-8.997***	-6.687***	-8.670***
	[10.382]	[7.306]	[9.167]	[7.179]	[10.330]	[7.206]
Observations	19444		19444		19444	
Log Likelihood	-3221.3		-3193.3		-3111.4	
Robust z statistics in brackets						
* significant at 10%; ** significant at 5%; *** significant at 1%						

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