

Do households use remittances to smooth consumption?*

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Yale University, May 5, 2009

Abstract

This paper explores the migration-development link by asking whether remittances are used to smooth consumption in rural Mexico. We construct a panel from rural household surveys collected by the Mexican government as part of its conditional cash transfer program, Oportunidades. The sample is restricted to those households that have a migrant in any of the survey years (1997-2000), leaving approximately 32 thousand household-years for our analysis. As there is considerable variation in whether the households receive remittances given migration, we estimate a sample selection logit and calculate the inverse mills ratio for the probability that a household receives remittances in each survey year. We then use an instrumental variables approach to estimate the effect of income shocks on remittances. To instrument for income we employ indices of self-reported and village aggregated shocks and losses due to natural disasters, as well as deviations of village-level rainfall data from its 20 year average. Our instruments predict income with consistency, though the instrumented income variable is not significant in the remittance equation once household characteristics are controlled for. The most important characteristics for predicting remittances include whether the migrant is spouse to the household head, and the head of the household's education.

*Preliminary, Please Do Not Cite

[†]This work has been supported by the Hewlett Foundation and the MacMillan Center at Yale University. We would like to thank the working group on Mexican Remittances formed by Gus Ranis at Yale University's Economic Growth Center for their comments at various stages of this project.

1 Introduction

The first decade of the twenty-first century has seen a tremendous movement of ideas, people, and capital to and from the corners of the globe. Globalization, the process of increasing market integration between big and small economies, between strong and weak states, has the potential to fundamentally alter the distribution of wealth and resources during our lifetimes. Some channels through which this global redistribution has and will continue to take place are well known – development aid, private flows of investment capital, research institutions that fund international scholars, and philanthropy – all recommend themselves to investment, collaboration and redistribution with the developing world. Yet this tide of formal and institutional flows might not suffice to lift the boats of the world’s poorest people.

Migration, the movement of one or many family members to a new location in search of work, is one important avenue through which a household might lift its own boat (by increasing collective resources, thereby improving welfare). This migration-development link was first explored in the seminal “Surplus Labor Model”, also known as the Lewis-Fei-Ranis model, which relates both urban and rural growth to migration. The basic idea behind this model rests on an assumption that the rural sector is inefficient because labor is too widely available relative to need. Thus, rural households, which are said to produce at a point where the marginal product of labor is below the wage, could lose laborers to the industrial sector while still maintaining the same level of output; the migrant could literally take his backpack of grain with him as he searches for higher wages in the city (see Ranis and Fei (1961), Sen (1966) or Lewis (1954)).

Although the Surplus Labor Model is no longer a dominant paradigm in development economics, the insight that migration may be a key to development has certainly persisted. Our interpretation of the relevant mechanism is not that the migrant simply leaves the household, but that he or she is useful to the family because of the transfers sent (in cash or kind) to those who were left behind. These transfers, known as remittances, can serve the migrant’s family or community in many important ways. Indeed, there are several narratives for why remittances matter: they

can facilitate village traditions by providing for ceremonies – weddings, birthdays, baptisms and other important community events (Durand et al. 1996, 428); they can support the construction of schools and churches (Sana 2008); allow for the private provision of “public” goods such as access to sanitation and water (Adida and Gerod 2009); or, as we will argue in this paper, remittances can facilitate development by increasing stability if they allow households to smooth consumption when weather, crop losses, or natural disasters negatively affect household income.

Some scholars and policy makers argue the opposite, asserting, in fact, that remittances reinforce dependency in the developing world. The evidence for dependency is mixed: Barham and Boucher (1995) find that that migrant-sending households choose to participate less in the labor market, ostensibly because remittances provide enough income for the household. Further, remittances actually increase inequality.¹ Finally, there is worry that remittances cause dependence because they are consumed rather than invested. However, Adams (2006) finds that rather than bolster consumption, remittances to Guatemalan households are, in fact, invested.

When it comes to questions of the development effect of remittances, different contexts produce different results. We hope to contribute to this debate by arguing that remittances should be considered within the context of the household (rather than, as will be discussed in the following section, using the individual migrant) as the unit of analysis, as their purpose is precisely to protect agricultural households against unforeseen shocks. In using the Oportunidades data we have the advantage of rich household characteristics and over-time variation in the migration and remittance data of interest, which allows us to test whether remittances operate to smooth consumption.

Two main methodological concerns are accounted for in our empirical strategy. The first is that there is a selection mechanism which causes some migrant-sending households to receive remittances while others do not. This concern is not purely

¹It should be noted that there is still substantial disagreement concerning the proper way to analyze inequality: Stark et al.’s (1986) method of comparing income distribution with and without remittances has been widely criticized for its assumption, similar to the Lewis-Fei-Ranis premise, that removing workers from the village does not negatively affect output. For more on this see Keskin’s paper at this conference, Adams (1989), Barham and Boucher (1995) etc.

theoretical; indeed, 34 percent of households in our sample never receive remittances despite having migrants during at least one survey year. We correct for this selection problem by estimating a logit regression for the probability of receiving remittances, given a vector of household migrant characteristics (e.g. how many male migrants are in the United States, how many female migrants are daughters of the household head). We use the logit to calculate the inverse Mills ratio for each household year, and then use this variable in our remittance equation.

The second methodological concern is that income and remittances are simultaneously realized, i.e. income may be endogenous to remittances. The Barnham and Boucher paper cited above, which shows that there are labor market (hence income) responses to remittances, provides some justification for this worry. We deal with endogeneity by instrumenting for income, using various self-reported shock and loss data, as well as exogenous rainfall data, in a two-stage least squares remittance equation.

The paper will proceed by describing in Section 2 the extant literature on migrant motivations and the remittance response to shocks. Section 3 will set the stage with a discussion of migration in the Mexican context, and present a highly stylized analytical framework for remittances as a consumption-smoothing mechanism at the household level. Section 4 contains a detailed description of our data, and Section 5 presents the results of our empirical investigation. We conclude with a discussion of ways in which this research can be enhanced.

2 Remittances and Development

The vast majority of the literature on remittances focuses on the individual migrant’s motivations to remit. Before developing a model of remittances as an income-smoothing strategy, we turn to this literature.

2.1 Motivations for an individual migrant

Most studies that consider why migrants remit argue that the individual migrant is the appropriate unit of analysis (Banerjee 1984; Cox 1987; Johnson and Whitelaw 1974). The research question can generally be understood as asking, “How does a

utility-maximizing individual take the decision to remit?” Potential answers to this question include the following:

1. *Pure Altruism*: The migrant is driven by a desire to help his or her sending household (i.e. the consumption of the recipient falls into the migrant’s utility function). Studies that support this hypothesis include Bouhga-Hagbe (2006) and Agarwal and Horowitz (2002).

2. *Pure Obligation*: The migrant is repaying her family for previous investment (e.g. the cost of schooling, or of crossing the border, inculcated social mores). Hoddinott’s (1992) study of remittances sent to households in Kenya, Bernheim, Shleifer and Summers (1985) and Cox (1987) are examples of work that support the “obligation” hypothesis.

3. *Enlightened Self-Interest* (a mixture of altruism, obligation and investment): The migrant is driven by the altruism motive, but is also motivated by his or her own well-being, especially in the case of anticipated returns. In a seminal paper, Lucas and Stark (1985), explore this motivation. They argue that a model of “tempered altruism or enlightened self interest” best explains remittance behavior. Using household survey data from Botswana, they appeal to two independent variables of interest: First, if migrants remit in order to repay prior educational investments, households with educated migrants should receive remittances. Second, if migrants remit as part of a household’s effort to diversify risk, those households that take on more risky production at home (e.g. by using new seeds/technology, by having cattle as the main asset) should receive more remittances. They find evidence for altruism in that the family head remits at statistically significant levels, though evidence for risk diversification is mixed: households with more cattle are weakly more likely to receive remittances. There is little evidence that the repayment of educational investment, as proxied by migrant children of the household head, matters.

4. *Insurance*: To ensure a migrant’s warm welcome in case of an un-anticipated return. Pozo and Dorantes (2006) test for the insurance motive by correlating host economy risk variables with remittance flows. They find strong evidence that those migrants with less-developed social networks, who are undocumented, or who work in seasonal occupations, tend to remit more. In effect, migrants with uncertain

futures insure themselves against the need to eventually return home by remitting more. Unlike previous literature on the subject, Pozo and Dorantes use host-country risk variables rather than home-country household characteristics to evaluate the insurance motive.

These studies offer important insights into the possible motivations of remitting migrants; however, for development economics, the question of individual motivations is of only secondary importance. Understanding which conditions lead to long term human and economic development is primary, and thus what matters is whether remittances can serve in the interest of the household. It is our contention that if remittances allow for stability in household consumption, they can contribute to this lasting development. We turn now to the small literature that considers household risk and remittances.

2.2 Remittances and consumption smoothing

Agricultural households are subject to much vulnerability: price shocks for both consumed and produced goods; malnutrition and general ill health; and threats of natural disasters and crop blights all add to the instability of the countryside. A number of studies have considered the role that family and community can play in collectively protecting against these risks (see, for example, Udry 1994). A primary concern is that with incomplete access to insurance markets, and with low or non-existent household savings, seemingly small shocks to income may have dramatic effects on household consumption and welfare. Two recent papers – by Yang and Choi (2007) and Quisumbing, McNevin and Godquin (2008) directly address these issues.

Yang and Choi (2007) use micro-level data from the Philippines to analyze the impact of income shocks on remittances. Their evidence shows that origin households use remittances as insurance. The authors use rainfall shocks as instrumental variables for changes in income, and find a negative correlation between income and remittances, meaning that remittances increase when income decreases.

Quisumbing, McNevin and Godquin (2008) also use Filipino micro data to test whether remittances affect the asset holdings, consumption expenditure, and credit

constraint status of households. In their analysis, the authors control for any “shocks experienced by the origin household” and by the migrant.²

The evidence suggests that remittances positively impact expenditures on housing, consumer durables, non-land assets and total expenditures of migrant-sending households in the Philippines. Drought shocks are found to have the biggest effect on households with below median land holdings and land size, net worth, as well as those who have greater than median levels of schooling (Quisumbing, McNevin and Godquin 2008, 12).

Although the two papers discussed above explore a number of important issues regarding the impact of household shocks on remittances, they leave some critical questions unanswered on the issue of remittances and consumption smoothing. We believe that our study improves on the current knowledge both because we have a dataset which offers us over-time variation in household, migrant, and remittance characteristics, but also because of the unique measures of shocks that we will employ: shocks at the household and village level and of particular losses suffered by the household. In the next section we will explore the unique characteristics of our data and sketch out a very stylized analytical framework to guide our thinking as we move to the empirical portion of the paper.

3 Migration and Remittances in the Mexican Context

The question of whether remittances allow households to smooth consumption could well be analyzed in a variety of settings, but is particularly salient in the case of Mexico and the United States given the countries’ historical migration linkages, and the non-trivial contribution that remittances make to Mexican national income. The Mexican Government estimates show that between 1990 and 2000, approximately 3.2 million migrants left Mexico for the U.S., with 77 percent making no return trip during that period (INEGI³); further, in 2006, international remittances accounted

²The survey used in the paper includes shocks “related to agriculture, political or social events [. . .] as long as they have resulted in a loss of income or caused [the household] to become seriously concerned or anxious about [their] welfare”.

³<http://www.inegi.org.mx>

for 3 percent of Mexico’s Gross National Income (Ratha and Xu, 2006⁴).

In addition to labor flows to the United States and other countries (including Canada, Spain, Bolivia, Guatemala, Germany, etc.), Mexico is also witness to substantial rural-urban migration within its borders. This intra-national migration, which we will call “internal” migration, provides an additional level on which to understand the household remittance patterns. Between 1990 and 2000, internal migrants in Mexico included 7.5 million persons, or approximately 5 percent of Mexico’s population. Current figures indicate that since 2000, emigration out of Mexico has increased substantially, with 10.7 percent of persons born in Mexico residing outside of the country (Ratha, Mahapatra, and Xu, data for 2005). However, the internal migration figures are only 2.7 percent of the total population (INEGI, data for 2005).

These statistics indicate that migration is a dynamic process, and present us with many avenues for interesting research. A question that immediately suggests itself is why has there has been a shift away from internal migration and toward emigration out of Mexico since 2000? One answer that our research supports is that external migration has higher returns, at least prior to the current global economic downturn, and that households might have responded to these returns by encouraging emigration instead of simply re-location within Mexico.

Before we turn to the data we would like to briefly sketch an analytical framework for understanding remittances as a consumption-smoothing strategy of households.

3.1 An Analytical Sketch

The main claim of this paper is that migration and remittances are a means to consumption smoothing for migrant sending families. The basic problem for households is to maximize per capita consumption over their lifetimes; their main decision is where and when to send migrants.

Consider a two-stage model wherein households maximize consumption across both stages. Total utility U for household h is a sum of the utilities from both stages:

⁴<http://econ.worldbank.org>

$$U_h = \sum_{i=0}^m \ln c_i^1 + \sum_{i=0}^m \ln c_i^2 \quad (1)$$

where c_i^1 and c_i^2 are consumption for household member i (where $i \in \{1, \dots, m\}$) in period 1 and period 2, respectively. Summation of each of these across all migrants is represented by C_h^1 in the first stage and C_h^2 in the second stage. In the first stage, families choose whether and where to send each adult as a migrant. In the first period, the family incurs a cost, x , for each migrant it sends. x can represent either the cost of the migrant's education or the travel fees associated with migration. This payment is, in a sense, the premium paid by the family to guarantee remittance transfers from the migrant.

$$C_h^1 = Y_h^1 - \sum_{i=0}^n x_i \quad (2)$$

Thus the household's consumption in the first period, C_h^1 , is equal to their income in that period Y_h^1 , minus the costs of sending each of the n migrants. In most cases, the higher the cost of migration x_i , the higher the household expects the migrant's future income to be. This explains the differential cost of, and future income from, external versus internal migration.

Consumption in the second period C_h^2 is the sum of the n migrants' consumption, C_n^2 , and the consumption of the $m - n$ household members left at home C_{m-n}^2 :

$$C_h^2 = C_n^2 + C_{m-n}^2 \quad (3)$$

where

$$C_n^2 = \sum_{i=0}^n c_i^2 \quad (4)$$

$$\text{and } C_{m-n}^2 = \sum_{i=0}^{m-n} c_i^2 \quad (5)$$

In the equations below, Y_{m-n}^2 is home country household income per capita in the second stage, Y_n^2 is the income of migrant i , which is a function of the amount spent by the family on the migration x_i , and r_i is the remittance amount sent by migrant i in the second stage.

$$C_h^2 = Y_{m-n}^2 + \sum_{i=0}^n r_i \quad (6)$$

$$C_n^2 = \sum_{i=0}^n Y_n^2 - \sum_{i=0}^n r_i \quad (7)$$

As there are diminishing returns to consumption for each household member, the household's utility will be maximized by a more equitable distribution in remittances. We assume that migrants in the second stage earn equal to or more than the home country average per capita earnings and thus send remittances as part of the household's decision to decrease income inequality and facilitate overall increase in utility. Remittances thus must increase with declines in home country household income per capita. We hypothesize that home country income in the second stage is likely to be a function of shocks to the household at home, and that remittances should show a noticeable increase following shocks that hurt household income in the home country.

4 Household Data

The most important data for this paper come from household surveys in rural Mexico covered by the Oportunidades conditional cash transfer program from 1997-2000. Under the program, the national government of Mexico gives cash to households with children under the age of 21 in both rural and semi-urban areas on the condition that the children attend school and visit health clinics for inoculations. We draw exclusively from the surveys conducted in rural areas.

The data begin in 1997 when the Mexican government surveyed villages in six Mexican states — Guerrero, Hidalgo, Michoacan, Puebla, Queretaro, San Luis Potosi and Veracruz — which were located in areas known to be extremely vulnerable. A

census was taken of every household and the households were subsequently given a rating of “very poor”, “somewhat poor”, “not very poor”, “not poor” or “not poor at all”. Of the 495 census villages in the first full survey, 314 were randomly selected to receive a Oportunidades transfer during the first two years of the program (summer 1998-summer 2000). The remaining 181 villages were used as a control and received the transfer after 2000. In the treated villages, households that were “somewhat poor” or “very poor” should have received an Oportunidades transfer, but the data represents a random sample of the households in each of the treatment and control villages. Over the course of three phases, the beneficiaries are spread among the 32 Mexican states, but the data for the latter phases was released only recently so our sample will only cover the preliminary program from 1997-2000.⁵ A map showing the location of our sample can be found in Appendix C.

One important fact to keep in mind when considering our results is that the villages in our sample were chosen from a pool of very poor villages and are arguably not representative of Mexico as a whole. This limits the generalizability of our results, but nevertheless allows us to draw meaningful conclusions for an important demographic.⁶ The data is also limited because in 1997, the census year, each household could only respond to questions about five migrants, but in later years the respondent was allowed to answer for as many migrants as the household would like to report. Less than one percent of the households have more than five migrants, however, so this omission should have negligible effects on our results.

⁵Oportunidades was structured by the Mexican government to reach the “the poorest (or most marginal) rural localities” (Coady 1) and thus targets the “worst off” people in these already-poor regions in Mexico. The program “aims to improve living standards of poor families” by targeting three components of development: education, health and nutrition (Behrman and Todd 1).

⁶One substantive benefit of using the Oportunidades data as opposed to the INEGI sample survey, the Mexican Migration Project, or the Mexican Family Life Survey, is the specificity of remittance amounts and migrant location information. Indeed, the INEGI does not distinguish between remittance payments made to the household from migrants and those that come from family or non-family members who reside in the same village. If the migrant is internal, the survey records in which state he or she resides; unfortunately, we have no way of knowing in what country an “extranjero” or external migrant is located but we are confident that most are in the U.S.

4.1 Migration and Remittance Data

The Oportunidades survey questions respondents about migration and remittances in the October/November enumeration during each of the survey years. A representative member of each household (almost always the household head) is asked whether someone has left the household and not returned during the last five years. In the full dataset, 34 percent of households report ever having a migrant. Restricting our sample to this group leaves us with data covering 31,753 household years. Appendix A contains a table of summary statistics by survey year.

As can be seen in Appendix A, there is considerable variation in the percent of households that have migrants in each year, ranging from 10 percent in 1997 to 50 percent in 1999 and then dips low again. The number of migrants also varies considerable over the sample. Appendix D presents histograms by year of the number of migrants in each household. Finally, from the sample of households that have migrants in a given year, there is considerable variation in those that also receive remittances, with 60 percent of 1997 migrant households receiving remittances, down to 33 percent in 1998 and 23 percent in 2000.

Given that a household has migrants, the enumerator then asks “has this migrant sent any money home? What is the amount?” In 1997 the time referent for this question was 12 months, though in later years the household was asked about remittances during the last 6 months. Thus, to make the data compatible, we have multiplied the remittance amounts for 1998-2000 by 2.

The two dependent variables we will analyze concern whether a household receives remittances and the amount received. First, for each household i in village v during year t , the household either receives remittances or it does not, hence:

$$r_{ivt} \in \{0, 1\} \tag{8}$$

We will construct a vector that represents a household-migrant profile M_{ivt} , which includes, for each household in the sample, the number of adult male and female migrants, the number of each who are living outside of Mexico, and the number that are sons and daughters of the household head (to signify closeness of kin). This

household-migrant profile will be used to estimate the probability that the household receives remittances.

Second, we will estimate a “remittance equation” using the remittances received R_{ivt} , where R is the total remittance received by the household i in village v during year t as the dependent variable.⁷ The following will be included as explanatory variables in the remittance equation: the migrant’s gender, location (in one of Mexico’s states or abroad), and the relationship to the household head. These variables are described in Appendix A, and a bar graph showing the kinship of migrants is included in Appendix D. Interestingly, only 2.5 percent of migrants are spouses to the household head, whereas 74 percent are children of the head, and 8 percent are their grandchildren.

The remittance equation also contains a vector of basic household characteristics H_{ivt} , which includes whether a household owns the land their house is on, whether they own other agricultural land, and the size of the household’s herd (cows and cattle) that the family own in a given year. The importance of the ownership and herd variables were delineated by Lucas and Stark (1985) as both a risky asset and something that could be inherited. Because we think that there is a relationship between these variables and one’s potential to inherit in the future, we have interacted all of the H_{ivt} with the number of sons in a household to unpack the inheritance hypothesis. A complete list of variables and their definitions are available in Appendix A.

4.2 Shock Data

To circumvent issues of simultaneity with the remittance and income vectors, we use a variety of data on agricultural shocks to instrument for income. For variables that come from the Oportunidades dataset, we use the shock data from the same survey in which the migration and remittances questions are asked, and aggregate up to the annual level.

⁷Note that all monetary values are recorded in real 1997 pesos, and that there are approximately ten pesos to the dollar throughout our sample frame. Summary statistics of the dependent variables can be found in Appendix A.

- Self-reported experience of natural disaster (1998-2000): The raw data are binomial variables that indicate whether a household has suffered from drought, flood, frost, fire, blight, earthquake or hurricane in the past 6 months:

$$s_{ivt} = \{0, 1\} \text{ with } s \in \{flood, drought, \dots, etc.\} \quad (9)$$

For each household i in village v during year t . Bar graphs showing both the breakdown of whether a shock occurred, and which disasters were most prevalent, by state, can be found in Appendix F.

- Self-reported loss data (1998-2000): similar to the natural disaster data, the household was asked what the consequences of the disasters were. We have binomial indicators for whether they lost land for crop cultivation, lost crops, the house, various household items, or whether an animal or member of the household was injured or died.
- Village level shock indices (1998-2000): because households might make riskier investments in the face of remittances (which might cause the shocks or losses suffered to be higher in these households), we constructed shock indices for each of these variables at the village level. The indices are the sum of the household shocks s_{ivt} for each village, divided by the number of households in that village during the survey year, n_{ivt} .

$$S_{s,vt} = \sum_{n=2}^{500} \frac{s_{ivt}}{n_{ivt}} \quad (10)$$

Given this formulation, $S_{s,vt}$ is a continuous variable that goes from zero to one. We have constructed histograms and bar charts to demonstrate the distribution of these shock variables, available in Appendix F.

- Deviation of rainfall from its 20 year average (1997-2000): Since Oportunidades does not ask the shock and losses questions in the first year, and to counter the possibility of bias due to the self-reporting, we also used rainfall data from

the Climate Research Unit’s Central America database (Mitchell and Jones, 2005). Using monthly rainfall data from 1981-2000, we constructed a 20 year average precipitation variable, $p20_w$, indexed to the rain grid at point w , and then constructed yearly averages for our survey years t : $p1_{wt}$. Thus P_{wt} is point w ’s deviation from the 20 year average precipitation in year t

$$P_{wt} = p1_{wt} - p20_w \tag{11}$$

We matched the grid points to the villages in our sample by using the Hawth’s Analysis tools in ArcGIS. In the empirical portion we will look both at P_{wt} for the grid point that is closest to the village, and at the same measure weighted by its inverse distance $(\frac{1}{d_{wv}})P_{wt}$ which gives the data more emphasis when the gridpoint is closer to the village.⁸

5 Empirical Analysis and Results

5.1 Strategy

In the theoretical portion of this paper we argued that migration is a strategy that households use to smooth consumption in the face of economic uncertainty. This uncertainty is borne out in each year by reductions to household income that cause family-oriented migrants to remit more than they would in the absence of such reductions.

Our empirical strategy will involve three steps. First, we estimate a log-odds (logit) regression for the decision to remit:

$$r_{ivt} = \beta_0 + \beta_x \mathbf{M}_{ivt} + \gamma T_{iv} + u_{ivt} \tag{12}$$

Where \mathbf{M}_{ivt} represents a vector of characteristics relevant to a household’s migration characteristics, T_{iv} is a dummy that is equal to one if the household resides

⁸The inverse distance weighted average has been informed by Sheppard’s (1968) discussion. We would like to take a weighted average of precipitation for the n closest rainstations, but for this iteration of the paper we have been unable to resolve the problem of directional repetition.

in an Oportunidades “treatment” village and was classified as eligible to receive the cash transfer, and u_{ivt} is the household year’s error term.

Second we calculate the inverse Mills ratio for each observation and use this new variable – the mills ratio – as a regressor in the remittance regression. Use of the Mills ratio, also known as the selection hazard or “Heckman’s” lambda, was proposed by Heckman (1979) to correct for processes of self selection by the individuals being analyzed. In our analysis, the self-selection we are concerned with has to do with whether a household receives remittances in a given year.⁹ The inverse Mills ratio, $\hat{\lambda}_{ivt}$, is given by the following equation:

$$\hat{\lambda}_{ivt} = \frac{\phi(\hat{r}_{ivt})}{1 - \Phi(\hat{r}_{ivt})} \quad (13)$$

where ϕ is the density function, Φ is the cumulative distribution function for a standard normal variable, and \hat{r}_{ivt} is the predicted value obtained by the logit regression in the first step for each household i in village v during year t . The inverse Mills ratio is a monotonically decreasing function of the probability of being in the sample of households with remittances on any given year. Thus as $E(r_{ivt}) \rightarrow 1$, given the explanatory variables contained in \mathbf{M} and T , λ_{ivt} decreases. In the second step, then, a lower value for λ_{ivt} corrects for the high probability of inclusion in the sample.¹⁰

Third, we estimate the remittance function using a two-stage least squares regres-

⁹In essence, the population that we consider in our analysis – those households who had migrants during at least one of the Oportunidades survey years – is not a random draw of the population. Thus, whether a given household has remittances (and the amount of these remittances) is also non-random. As Heckman elegantly describes the problem, “fitted regression functions confound behavioral parameters of interest with parameters of the function determining the probability of entrance into the sample,” when self-selection occurs without correction, (1979:154).

¹⁰The inverse Mills ratio also helps to take account of the indirect effects of variables that appear in both stages of the regression, so long as at least one variable appears only in the first stage. The regressor that will be left out as we move to the next estimates will be T_v , the dummy that controls for whether a household was eligible to receive the Oportunidades transfer. The rationale behind excluding this particular variable is that though being eligible for a transfer may affect whether a households receive remittances (e.g. an eligible household may be too poor to have migrants), it should not affect the amount of remittances in any way that isn’t already captured in the income variables.

sion (2SLS) where the dependent variable, remittance per migrant R_{ivt} is dependent on a vector of household characteristics \mathbf{H}_{ivt} , the income of the household Y_{ivt} , the inverse Mills selection variable $\hat{\lambda}_{ivt}$, and a household specific error term.

$$R_{ivt} = \beta_0 + \beta_x \mathbf{H}_{ivt} + \delta_p \hat{Y}_{ivt} + \hat{\lambda}_{ivt} + u_{ivt} \quad (14)$$

We instrument for household income Y_{ivt} using various indicators of shock and loss \mathbf{S} .

$$Y_{ivt} = \alpha_0 + \zeta \mathbf{S} + v \quad (15)$$

$$\mathbf{S} = (\mathbf{S}_{vt}, \mathbf{S}_{ivt}, \dots, P_{vt}, P_{ivt}^{an}) \quad (16)$$

The \mathbf{S} and v components will have errors depending on whether the shock variables are aggregated to the household or the village level. P_{ivt}^{an} is the interaction between the precipitation variable and the number of small animals in the household, which allows the precipitation indicators to vary by household.¹¹

Our assumption in using the instrumental variables is that the shock variables have an effect on remittances only through their effect on income, meaning that v is orthogonal (strictly uncorrelated) with u_{ivt} . We believe that shocks will operate in the following way: if the shock affects income, the migrant will be inclined to remit payments; if not, the remittance cannot be attributed to consumption smoothing.¹²

¹¹The number of small animals in the household has approximately zero correlation ($r=-0.0035$, $p\text{-val}=0.53$) to remittances per migrant

¹²We believe this to be a valid assumption, though perhaps a simple vignette might help to illustrate the point: suppose that a mother's relationship with her daughter is such that the mother has agreed to help the daughter smooth her consumption during her college years. One day the daughter is robbed on the street, her purse is stolen and along with it a cell phone and some hundred dollars or so of cash. This is a situation in which the daughter has suffered from a shock that has had an impact on her ability to consume (both because the money was taken and because she will have to replace the cell phone). The mother, acting in her role as consumption smoother, is quick to the rescue: a check is in the mail the next day. Now suppose that instead of being robbed with a fully equipped pocketbook, the daughter was instead accosted on her way to the grocery store, with nothing but an empty canvas bag (and a credit card safely tucked in her pocket). In this case, the mother has no obligation to send any money for consumption smoothing as the shock hasn't

5.2 Results

5.2.1 Logit estimation to calculate inverse Mills Ratio

Table 3 shows the results from the first stage of our regression, both models are run using the logit specification, and marginal effects are the reported coefficients. The first model looks at the probability that a household will have remittances using broadly aggregated categories of migrant characteristics. The first five variables in column (1) are dummy variables equal to one if the household has, respectively, female or male migrants, a migrant residing outside of Mexico, or migrants that are either the son or daughter of the household head. The signs of the coefficients on each of these variables fit nicely with our intuition about which types of migrants remit. For example, the most important economic determinant of remittances is whether the migrant resides outside the United States, with both male migrants and sons of the household heads also having positive effects on the probability of remittances. The coefficient for female migrants is negative and statistically significant, though daughters are more likely to remit. Finally, the treatment dummy, which equals one if a household is in a treated village and eligible for the transfer, has a negative effect on the marginal propensity of a household to receive remittances.

Column (2) in Table 3 disaggregates the dummy variables from the first column to indicate their cardinal values, i.e. we include the numbers of migrants that each household has in a given year that falls into each category. The direction of the coefficients in column (2) mimic those in the former column, though the treated and son migrant variables no longer maintain their significance. We read these coefficients as saying that the marginal effect of having an additional son migrant is zero, though of course the marginal effect of having son migrants, in general, is non-trivial.

Following Wooldridge (2005), we calculated a goodness of fit measure to estimate the percent correctly predicted by each of our models. The equation is as follows:

if

$$G(\beta_0 + \beta_x \mathbf{M}_{ivt} + \gamma T_{iv}) > .5$$

then the model predicts a probability of 1;

affected the daughter's ability to consume.

if

$$G(\beta_0 + \beta_x \mathbf{M}_{ivt} + \gamma T_{iv}) \leq .5$$

then the model predicts a probability of 0.

Using this formulation, column (1) gets the correct prediction in 76.4 percent of the cases, whereas column (2) gets the correct prediction in 89.9 percent of the cases. Because of its superior prediction power, and the fact that we retain more observations, we will use the model in column (2) to predict the inverse Mills ratio, λ_{ivt} .

5.2.2 Do our instruments do a good job predicting income?

Before we proceed with the instrumental variables approach outlined above, we turn to Tables 4 and 5 to see whether our self-reported shock variables or rainfall variables (respectively) do a good job of predicting income.

For each type of shock: village shock index, household shock dummies, and household loss index, Table 4 contains the results of regressions run on log of household income for both random effects and fixed effects specifications. For the village shock index, the fixed effect will be at the village level, for the household variables, the fixed effect is at the household level.

Columns (1) and (2) of Table 4 show that, though all indices except for the frost index have a negative effect on income, those that are statistically significant in both models include only the blight and hurricane indices. We expect the standard errors in these two specifications to be quite large, given the fact that the index is on the village level, but the log of household income is measured per household-year.

Columns (3) and (4) of Table 4 contain household dummies for the various shocks. These variables indicate that there is a negative relationship with income for all but the drought variable under the random effects estimate. The fixed effect model shows that drought, frost, earthquake and hurricane all have statistically significant and negative relationships with income. This model is likely closer to the true model as it allows for heterogeneity between households (i.e. it allows for each household to have a unique intercept).

Finally, columns (5) and (6) show the relationship between log household income and self-reported loss dummies. These results are interesting: though losing crops has a negative and statistically significant relationship with income, losing animals is significant and positive. It would be a stretch to surmise what is causing the positive relationship between income and lost animals, and we will not attempt to do so at this time.

Table 5 turns to our exogenous instruments to see whether rainfall shocks are good predictors of income. Column 1 considers the effect on income of rainfall from the closest station. The variables include the deviation from the 20 year mean, and that deviation squared. Column (1) includes village fixed effects, as each household in the village will have the same data point, and no significant results appear. The second regression looks also at the closest rain station, but this time the deviation and deviation squared have been multiplied by a scalar, the number of small animals in the household, to allow the data to vary at the household level. The number of small animals in the household has approximately zero correlation ($r=-0.0035$, $p\text{-val}=0.53$) to remittances per migrant (the dependent variable in the next step). Column (2) shows an inverted U relationship between deviation from 20 year rainfall and income: Income increases but at a decreasing rate when rainfall is higher than average.

Column (3) shows the deviation from 20 year weighted average (and its square) for the five closest rainfall stations. The relationship exhibited at the village level is that of a U, but when we allow the vectors to vary by household, using the number of small animals, the relationship discerned in column (2) remains. The coefficients and standard errors in all of these columns are quite small, indicating that, though they might be statistically significant, the economic significance might not be as important when other variables are controlled for.

5.2.3 Is income, instrumented by shocks, driving remittances?

Tables 6, 7 and 8 present the instrumental variable remittance equations in the following order: Table 6 looks at self-reported shocks, losses, and village indices. Table 7 looks at deviations from 20 year average rainfall at the closest rainstation, and

Table 8 looks at deviations of weighted 20 year averages for the 5 closest rainstations. The dependent variable follows our analytical sketch and represents the remittance per migrant. When the household had no migrant, the dependent variable takes on the value of zero.

Each regression includes the variable *imr* which is the inverse Mills ratio that was calculated for each household year using the second column of coefficients in Table 3. In all three tables, the inverse Mills variable is the largest and most important predictor of receiving remittances. If the IMR is high, the remittances that the households receive are lower. This is as expected as the inverse Mills ratio “punishes” those households that were more likely to receive remittances based on the migrant characteristics in Table 3.¹³

It is interesting to note that income (as instrumented by the shock variable specified in the column header of each table) is never a statistically significant determinant of remittances once other variables are controlled for. In Table 6, income has the expected negative sign: if income increases, remittances should decrease (in fact, if the household is operating as a unit with the migrant, higher income should mean negative remittances, something that is not observed in the data).¹⁴ Tables 7 and 8 show no significant relationship between income and remittances, and the sign bounces around to a great extent.

Aside from the inverse Mills ratio, the second best predictor of remittances is whether the migrant was the spouse of the household head, which occurs in only 1.67 percent of our cases. Our analytical framework specified that the household smooths consumption by deciding where and when to send a migrant, and that it receives more remittances when times are tough. The assumption that we made is that the migrant remains a member of the household though he or she lives elsewhere, and it is for this reason that he or she acquiesces to the bargain. The positive and

¹³In essence, the characteristics that were likely to cause selection into the remittance pool should not count again, positively, towards those determinants of the remittance function.

¹⁴Our definition of income can be negative, however, if transfers out of the house were greater than income plus transfers in. Unfortunately there is no way to link up transfers out of the house with transfers to migrants, however the survey does ask whether each transfer was for someone ‘in the same village’ ‘in a close village’ or ‘far away’, and for the majority of those cases (76-88 percent) were not to persons located far away.

significant coefficient on the spouse variable across all specifications may imply that those members who see themselves as remaining in the family are indeed more likely to remit. We plan to, in the next iteration, look at the single cross section of 1998 in which there are better measures of the reason for leaving. We think that daughters who leave to get married will join a new household and be less likely to remit, all else equal.

The final explanatory variable of note is that the head of the household's education, in all specifications but one, is positively related to remittances per migrant. It could be that this variable is indicative of the migrant's education, which, when higher, would allow for higher labor market returns.

6 Conclusions and Future Research

The end of this paper seems, in fact, to suggest the beginning of a larger research project. We have shown that though shock variables – self reported, aggregated indices, and exogenous rainfall data – seem to predict income with some consistency, income, when instrumented by these shocks, is not a great predictor of remittances. This means that we must either re-think our model (i.e. argue for other explanations of migrant remittances) or we must be more particular with the definition of the migrant: Is a daughter who marries into another household, strictly speaking, a migrant? Is a student that leaves for school, strictly speaking, a migrant? Should we expect different remitting patterns based on whether the individual is likely to return to the household (e.g. the spouse), or based on their immigration status (e.g. documented or undocumented)? These and other important questions are certainly worth considering in future research.

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A Summary Statistics

Table 1: Descriptive Statistics of Households with Migrants

Variable Names	1997	1998	1999	2000	All
has migrant in survey year	0.10 (0.30)	0.47 (0.50)	0.49 (0.50)	0.40 (0.49)	0.37 (0.48)
=1 hh ever has remit	0.34 (0.48)	0.35 (0.48)	0.34 (0.48)	0.34 (0.47)	0.34 (0.48)
Internal Remittances	28.35 (354.00)	811.99 (12012.90)	468.49 (7812.32)	143.07 (2744.39)	367.16 (7370.15)
External Remittances	260.13 (3250.34)	321.97 (4418.57)	389.45 (5024.92)	628.96 (7038.87)	396.29 (5084.25)
total remittances	288.48 (3274.03)	1133.97 (12781.14)	857.94 (9270.74)	772.04 (7548.77)	763.45 (8940.30)
Remittances Per Migrant	214.46 (2195.02)	785.43 (8966.19)	609.09 (6773.53)	568.84 (5774.92)	544.35 (6431.93)
=1 hh has external migrant	0.52 (0.50)	0.16 (0.37)	0.15 (0.36)	0.23 (0.42)	0.20 (0.40)
=1 hh has male migrant	0.77 (0.42)	0.61 (0.49)	0.60 (0.49)	0.67 (0.47)	0.63 (0.48)
=1 hhhas female migrant	0.35 (0.48)	0.52 (0.50)	0.58 (0.49)	0.60 (0.49)	0.55 (0.50)
=1 hh has migrant daughter	0.31 (0.46)	0.49 (0.50)	0.49 (0.50)	0.46 (0.50)	0.47 (0.50)
=1 hh has migrant son	0.63 (0.48)	0.56 (0.50)	0.52 (0.50)	0.54 (0.50)	0.54 (0.50)
number adult female mig	0.04 (0.25)	0.34 (0.70)	0.37 (0.68)	0.32 (0.66)	0.27 (0.62)
number of adult male mig	0.10 (0.39)	0.39 (0.73)	0.39 (0.71)	0.37 (0.71)	0.31 (0.66)
number female external	0.01	0.03	0.03	0.03	0.03

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... table 1 continued

Variable Names	1997	1998	1999	2000	All
	(0.13)	(0.21)	(0.20)	(0.22)	(0.19)
number adult external	0.06	0.09	0.08	0.11	0.09
	(0.31)	(0.38)	(0.35)	(0.39)	(0.36)
number of son migrants	0.08	0.37	0.34	0.30	0.28
	(0.37)	(0.75)	(0.70)	(0.66)	(0.65)
number of daughter mig	0.04	0.33	0.32	0.24	0.23
	(0.24)	(0.72)	(0.66)	(0.57)	(0.59)
=1 if hh in a treatment village	0.62	0.62	0.60	0.61	0.61
	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)
=1 if hh receives progresa	0.29	0.30	0.45	0.46	0.37
	(0.45)	(0.46)	(0.50)	(0.50)	(0.48)
Sum of Cows and Cattle	1.35	0.17	0.91	0.94	0.83
	(4.11)	(1.18)	(3.15)	(4.20)	(3.39)
son migrant x herd	1.45	0.09	0.44	0.68	0.46
	(4.79)	(0.87)	(1.79)	(2.98)	(2.32)
=1 if hh owns land house	0.93	0.93	0.93	0.93	0.93
	(0.26)	(0.26)	(0.26)	(0.25)	(0.26)
son migrant x own house land	0.60	0.52	0.49	0.50	0.51
	(0.49)	(0.50)	(0.50)	(0.50)	(0.50)
=1 if hh owns land for ag, other	0.70	0.71	0.71	0.71	0.71
	(0.46)	(0.46)	(0.45)	(0.45)	(0.45)
son migrant x agric land	0.47	0.39	0.38	0.39	0.39
	(0.50)	(0.49)	(0.49)	(0.49)	(0.49)
village drought index	.	0.36	0.47	0.13	0.32
	(.)	(0.27)	(0.29)	(0.19)	(0.29)
village flood index	.	0.04	0.08	0.02	0.04
	(.)	(0.07)	(0.15)	(0.03)	(0.10)
village frost index	.	0.04	0.16	0.03	0.07
	(.)	(0.06)	(0.24)	(0.08)	(0.16)
village fire index	.	0.01	0.00	0.00	0.01

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... table 1 continued

Variable Names	1997	1998	1999	2000	All
	(.)	(0.04)	(0.02)	(0.00)	(0.03)
village blight index	.	0.10	0.05	0.01	0.06
	(.)	(0.16)	(0.08)	(0.03)	(0.11)
village earthquake index	.	0.00	0.07	0.00	0.02
	(.)	(0.01)	(0.19)	(0.02)	(0.11)
village hurricane index	.	0.01	0.06	0.00	0.03
	(.)	(0.04)	(0.12)	(0.02)	(0.08)
=1 hh drought	.	0.39	0.48	0.14	0.34
	(.)	(0.49)	(0.50)	(0.35)	(0.47)
=1 hh flood	.	0.04	0.09	0.02	0.05
	(.)	(0.20)	(0.29)	(0.12)	(0.22)
=1 hh frost	.	0.04	0.17	0.03	0.08
	(.)	(0.20)	(0.38)	(0.18)	(0.27)
=1 hh fire	.	0.01	0.00	0.00	0.01
	(.)	(0.11)	(0.07)	(0.04)	(0.08)
=1 hh blight	.	0.12	0.06	0.01	0.06
	(.)	(0.32)	(0.23)	(0.10)	(0.24)
=1 hh earthquake	.	0.00	0.07	0.00	0.02
	(.)	(0.04)	(0.25)	(0.04)	(0.15)
=1 hh hurricane	.	0.01	0.07	0.00	0.03
	(.)	(0.11)	(0.25)	(0.06)	(0.16)
=1 lost land	.	0.06	0.22	0.04	0.11
	(.)	(0.24)	(0.42)	(0.19)	(0.31)
=1 lost crop	.	0.38	0.50	0.14	0.34
	(.)	(0.48)	(0.50)	(0.35)	(0.47)
=1 lost house	.	0.01	0.01	0.00	0.01
	(.)	(0.09)	(0.11)	(0.05)	(0.09)
=1 lost goods	.	0.00	0.01	0.00	0.00
	(.)	(0.04)	(0.09)	(0.04)	(0.06)
=1 death in fam	.	0.00	0.00	0.00	0.00

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... table 1 continued

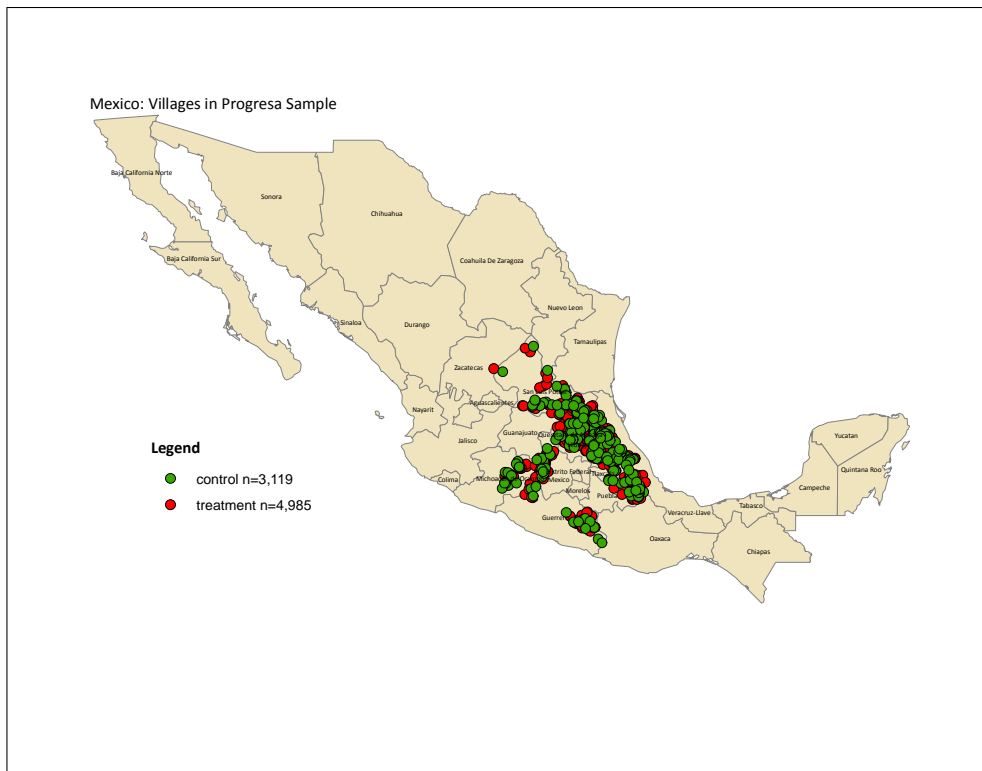
Variable Names	1997	1998	1999	2000	All
	(.)	(0.02)	(0.02)	(0.00)	(0.02)
=1 lost animals	.	0.04	0.06	0.01	0.03
	(.)	(0.20)	(0.23)	(0.09)	(0.18)
=1 hh member injured	.	0.00	0.00	0.00	0.00
	(.)	(0.03)	(0.04)	(0.02)	(0.03)
average rainfall, closest	959.03	1030.80	1109.97	1248.22	1084.04
	(450.62)	(522.69)	(523.82)	(569.03)	(528.21)
20-year av rainfall, closest	1002.44	1001.66	1005.02	1005.49	1003.61
	(463.24)	(461.81)	(463.17)	(458.69)	(461.75)
deviation from 20 yr av	-43.41	29.14	104.94	242.74	80.44
	(43.76)	(99.09)	(72.27)	(126.54)	(138.54)
inverse dist closest station	7.18	7.19	7.16	7.17	7.18
	(7.96)	(8.06)	(7.98)	(7.98)	(8.00)
distance to rain station 1	0.31	0.31	0.32	0.33	0.32
	(2.69)	(2.67)	(2.82)	(2.86)	(2.76)
deviation from 20 year weig av	26.96	60.53	86.73	142.73	78.09
	(52.64)	(78.08)	(70.31)	(90.65)	(85.06)

B Differences in Means Tables

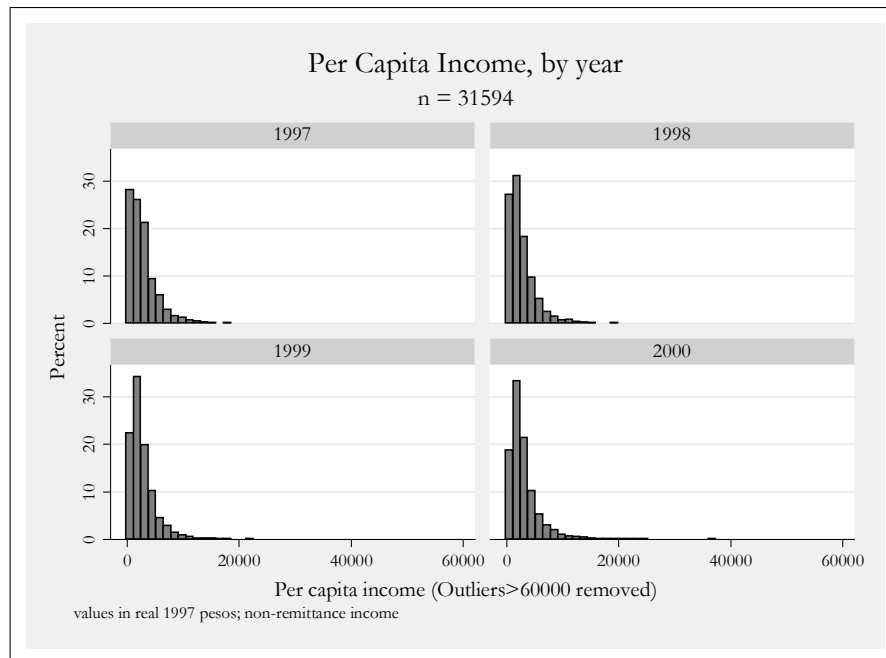
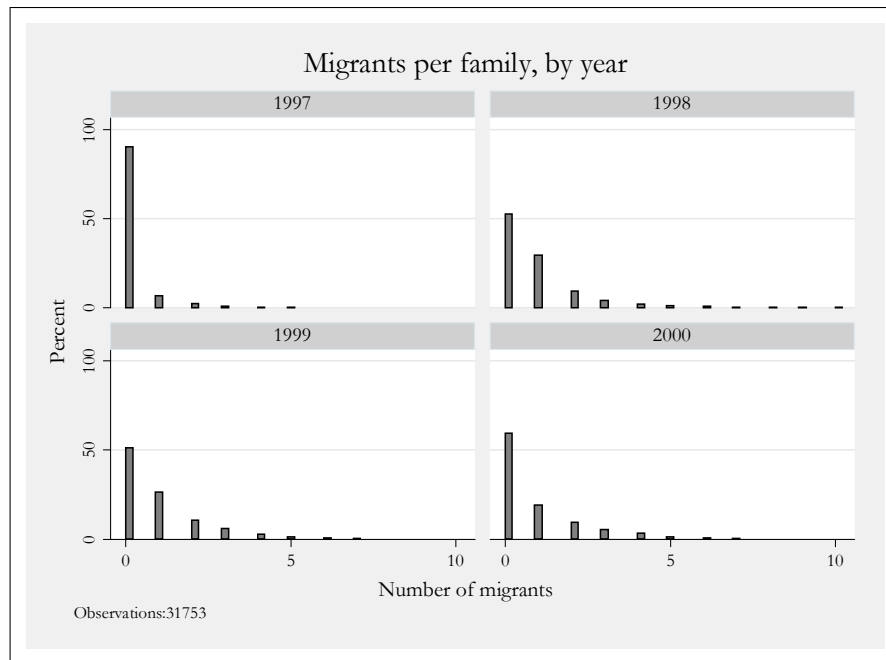
Table 2: Difference in Means Tests: Compare migrant HHs by whether they ever received remittances

	Obs	Mean	Obs	Mean	Difference	P-Value
number people in hh	22873	5.54	2383	4.68	0.86	0.00
number of kids in hh <15	27865	2.29	3251	2.07	0.22	0.00
number of families in hh	27616	1.02	3158	1.02	0.00	0.74
Number of migrants	28429	0.55	3324	1.88	1.33	0.00
number rooms in hh	27616	2.20	3158	2.30	0.10	0.22
total yearly hh income	28429	38946.10	3324	31922.50	7023.60	0.61
head of hh education	27616	2.17	3158	2.08	0.08	0.06
=1 if male is head of hh	27602	0.88	3156	0.83	0.05	0.00
head of hh speaks spanish	27616	0.27	3158	0.20	0.07	0.00
House has plumbing	27533	0.08	3150	0.08	0.01	0.29
House has electricity	27596	0.77	3154	0.81	0.04	0.00
=1 if hh owns house	27616	0.97	3158	0.97	0.00	0.40
=1 if hh owns land house is on	27616	0.93	3158	0.94	0.01	0.02
=1 hh owns land for ag	27616	0.71	3158	0.70	0.01	0.47
Number of Cattle	28418	0.39	3324	0.36	0.03	0.47
=1 if own 1 car, =2 if more	27616	0.12	3158	0.14	0.02	0.00
average ed of adults in hh	27605	3.70	3157	3.64	0.05	0.20
average ed of adult males	26265	3.86	2898	3.85	0.01	0.89
average ed of adult females?	27087	3.26	3107	3.20	0.06	0.21
percent of resp who are literate	27616	0.67	3158	0.68	0.01	0.01
percent of resp speak Spanish	27616	0.21	3158	0.16	0.05	0.00

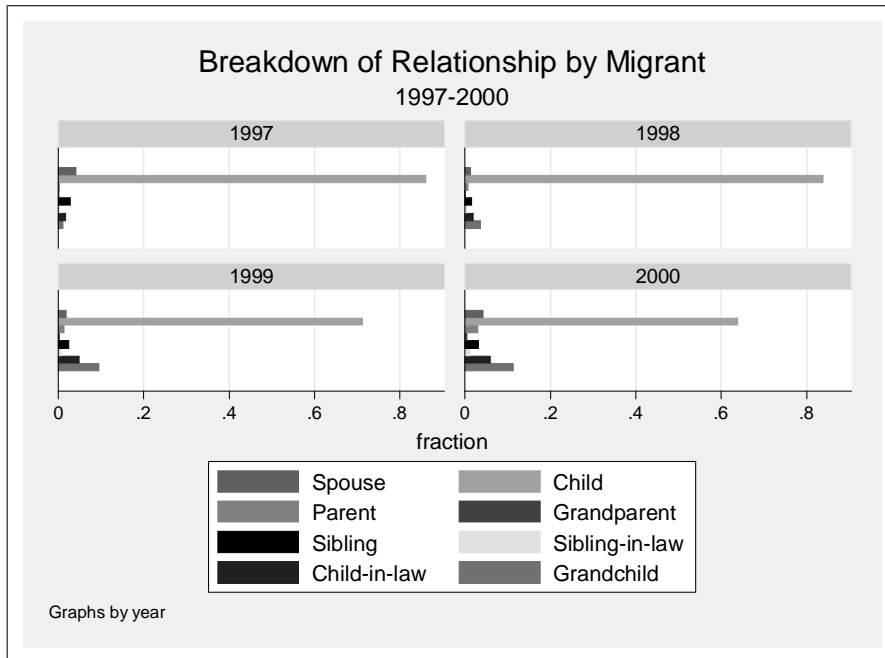
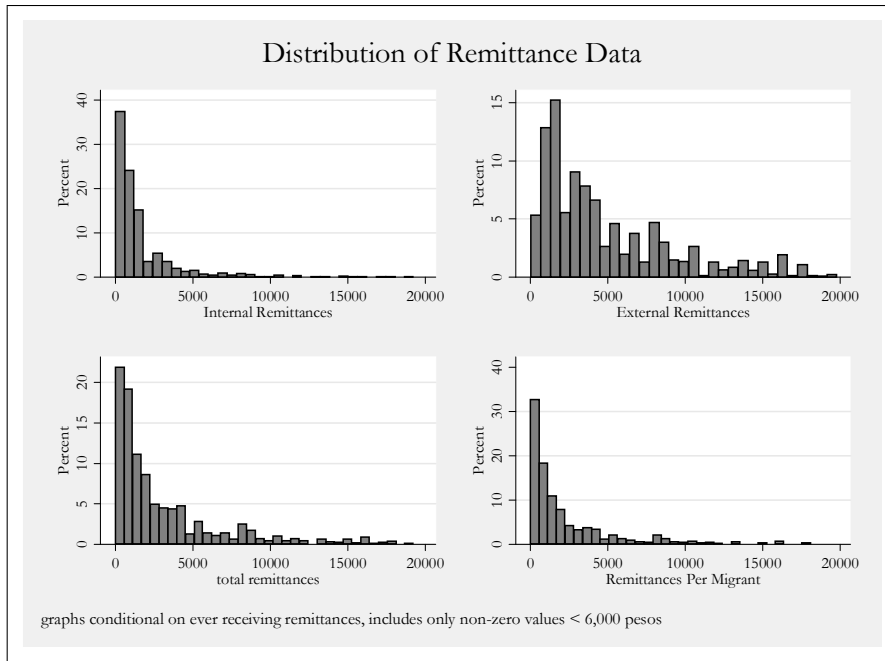
C Map of Sample



D Histograms of Summary Statistics



E Histograms of Remittance Data



F Distribution of Shocks by State

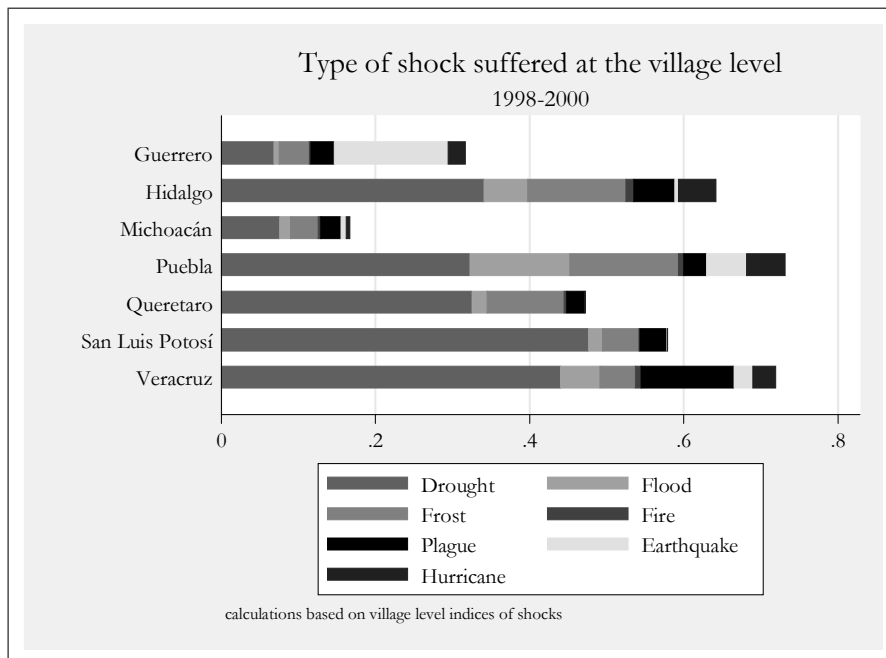
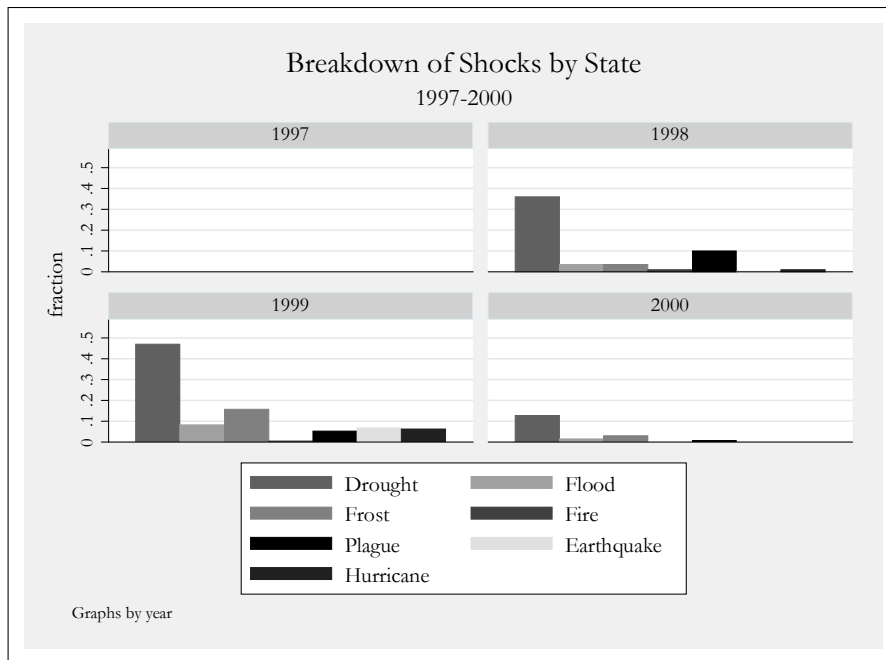


Table 3: Logit to calculate Inverse Mills Ratio. Dependent Variable: Does the Household have Remittances?

	(1) Dummies for Migrant Categories	(2) Cardinal Representation of Migrants
female	-0.648 (0.0698)***	
male	0.593 (0.0751)***	
externalmig	1.566 (0.0498)***	
son	0.130 (0.0637)*	
dau	0.597 (0.0738)***	
treated	-0.137 (0.0466)**	-0.0834 (0.0449)
nfamig		-0.265 (0.0567)***
nmamig		0.992 (0.0528)***
nfaext		0.478 (0.0871)***
nmaext		1.638 (0.0538)***
nsonmigrants		-0.0708 (0.0506)
ndaughtermigrants		0.856 (0.0551)***
<i>N</i>	11594	31753
pseudo R^2	0.121	0.253

Marginal effects; Standard errors in parentheses

(d) for discrete change of dummy variable from 0 to 1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Do self-reported shocks predict income?

	(1)	(2)	(3)	(4)	(5)	(6)
	Vill shock index	Village, fe	HH shock	HH shock, fe	HH loss	HH loss, fe
vill drought ind	-0.0692 (0.0286)*	-0.0288 (0.0309)				
vill flood ind	-0.104 (0.0812)	-0.0796 (0.0859)				
vill frost ind	0.0491 (0.0489)	0.0912 (0.0514)				
vill fire ind	-0.719 (0.285)*	-0.727 (0.310)*				
vill blight ind	-0.410 (0.0694)***	-0.500 (0.0755)***				
vill earthquake ind	-0.0110 (0.0640)	-0.0535 (0.0678)				
vill hurricane ind	-0.860 (0.104)***	-0.960 (0.112)***				
=1 hh drought			0.00961	-0.0635		

	(0.0164)	(0.0191)***
=1 hh flood	-0.0267 (0.0343)	0.0264 (0.0397)
=1 hh frost	-0.0310 (0.0276)	-0.0988 (0.0329)**
=1 hh fire	-0.0282 (0.0983)	0.0561 (0.114)
=1 hh blight	-0.0681 (0.0314)*	-0.0150 (0.0354)
=1 hh earthquake	-0.0251 (0.0490)	0.279 (0.0558)***
=1 hh hurricane	-0.248 (0.0460)***	-0.183 (0.0522)***
=1 lost land		-0.0176 (0.0238)
		-0.0749 (0.0276)**
=1 lost crop		-0.0706 (0.0158)***
		-0.0900 (0.0189)***

=1 lost house	-0.0783 (0.0834)	-0.0223 (0.0974)
=1 lost goods	0.00210 (0.126)	0.158 (0.150)
=1 death in fam	0.360 (0.380)	0.532 (0.468)
=1 lost animals	0.127 (0.0402)**	0.125 (0.0478)**
=1 hh member injured	0.0922 (0.224)	0.125 (0.261)
Observations	22610	22610
Adjusted R^2	0.001	-0.590

Dependent Variable: Log of Household Income

(d) for discrete change of dummy variable from 0 to 1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Do rainfall shocks predict income?

	(1)	(2)	(3)	(4)
	Closest Station, vfe	Closest x AN, hhfe	Weighted Average, vfe	Weighted Av x An, hh
deviation from the 20 year mean	0.0000631 (0.0000827)			
close rain, sq	-3.12e-08 (0.00000219)			
close rain x an		0.0000618 (0.0000139)***		
close rain x an, sq		-8.55e-08 (2.53e-08)***		
weight avg, dev from 20 yr			-0.000720 (0.000153)***	
weight avg, sq			0.00000187 (0.00000496)***	
weigh av X an				0.0000998 (0.0000217)***
weigh av X an, sq				-0.00000217 (5.74e-08)***
Observations	29445	28819	29445	28819
Adjusted R^2	-0.005	-0.414	-0.004	-0.415

Dependent Variable: Log of Household Income, fixed effects dependent on unit of analysis

(d) for discrete change of dummy variable from 0 to 1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Remittance IV (A): Self Reported Shocks Instrumented for Income

	(1)	(2)	(3)	(4)	(5)	(6)
	HH shocks, fe	HH shocks, re	HH losses, fe	HH losses, re	Village shocks, fe	Village shocks, re
loghhinc	-1993.9 (928.2)*	-850.0 (575.9)	-97.98 (1071.2)	-609.2 (667.1)	-1231.9 (559.7)*	-372.6 (395.3)
imr	-7160.8 (1079.6)***	-7629.2 (656.9)***	-8875.2 (1167.0)***	-7611.8 (655.5)***	-7849.9 (833.3)***	-7595.5 (651.0)***
spousemig		3041.2 (414.3)***		3016.8 (413.8)***		2993.6 (410.3)***
number people in hh		145.1 (108.6)		101.7 (123.8)		59.44 (78.30)
number of kids in hh <15		-113.0 (75.30)		-87.33 (82.65)		-62.51 (60.90)
head of hh education		55.66 (26.59)*		55.87 (26.64)*		56.10 (26.69)*
=1 woman head		84.92 (190.7)		111.7 (194.7)		138.0 (185.9)
House has electricity		175.0 (152.7)		152.6 (156.2)		130.4 (148.4)
perc HH literate		100.1 (342.6)		-1.272 (372.1)		-101.5 (294.3)
perc HH spk Span		-317.4 (226.4)		-256.6 (243.5)		-196.3 (198.3)
Observations	22610	15242	22610	15242	22610	15242
Adjusted R^2						

Dependent Variable: Remittances per migrant

(d) for discrete change of dummy variable from 0 to 1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Remittance IV (B): Closest Rainfall Station (deviation) Instrumented for Income

	(1)	(2)	(3)	(4)
	Closest Station, hhfe	Closest Station, re	Closest x AN, hhfe	Closest x AN, re
loghhinc	120.1 (813.2)	17.99 (366.8)	34.42 (1101.5)	-15.39 (771.9)
imr	-8813.4 (864.1)***	-8207.8 (504.7)***	-8792.5 (1091.8)***	-7882.6 (500.1)***
spousemig		2839.5 (337.1)***		2841.8 (350.5)***
number people in hh		1.936 (63.53)		-2.625 (140.7)
number of kids in hh <15		-16.79 (50.95)		-18.34 (98.63)
head of hh education		40.02 (27.75)		39.77 (19.72)*
=1 woman head		171.6 (194.0)		124.4 (142.4)
House has electricity		84.15 (155.9)		73.78 (123.0)
perc HH literate		-206.8 (298.2)		-179.2 (343.8)
perc HH spk Span		-129.2 (197.7)		-109.1 (217.8)
Observations	29445	22069	28819	22069
Adjusted R^2				

Dependent Variable: Remittances per migrant, fixed effects dependent on unit of analysis

(d) for discrete change of dummy variable from 0 to 1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Remittance IV (C): Weighted Average 5 closest stations (deviation) Instrumented for Income

	(1)	(2)	(3)	(4)
	Weighted Average, hhfe	Weighted Average, re	Weighted Av x An, hhfe	Weighted Av x An, r
loghhinc	293.9 (1032.0)	-365.2 (794.5)	-469.6 (1236.6)	-374.2 (1647.0)
imr	-8963.9 (1024.7)***	-7944.0 (500.3)***	-8351.0 (1198.4)***	-7912.1 (516.3)***
spousemig		2891.7 (352.8)***		2895.3 (412.8)***
number people in hh		60.20 (142.7)		61.75 (296.7)
number of kids in hh <15		-59.74 (98.84)		-61.48 (200.9)
head of hh education		41.10 (20.46)*		41.13 (20.52)*
=1 woman head		108.5 (148.5)		104.0 (164.7)
House has electricity		104.0 (128.2)		102.5 (169.7)
perc HH literate		-47.36 (358.1)		-43.01 (650.3)
perc HH spk Span		-194.6 (224.9)		-192.2 (401.7)
Observations	29445	22069	28819	22069
Adjusted R^2				

Dependent Variable: Remittances per migrant, fixed effects dependent on unit of analysis

(d) for discrete change of dummy variable from 0 to 1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$