Land Property Rights and International Migration:

Evidence from Mexico

Michele Valsecchi*

University of Gothenburg

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Abstract

In this paper we ask whether there is a relationship between land property rights and international migration. In order to identify the impact of property rights, we consider a country-wide land certification program that took place in Mexico in the 1990s. Our identification strategy exploits the timing of the program and the heterogeneity in farmers' eligibility for the program. Comparing eligible and ineligible households, we find that the program increased the likelihood of having one or more members abroad by 12 percent. In terms of number of migrants, our coefficient estimates explain 31 percent of the 1994-1997 increase in migrants from ejido areas and 16-18 percent of the increase from the entire Mexico. We contribute to the current debate on the determinants of Mexican emigration (Hanson 2006, Hanson and McIntosh 2009, Hanson and McIntosh 2010). Consistent with our theoretical model, the impact is strongest for households without a land will.

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1 Introduction

From 1990 to 2005, the share of Mexicans in the United States increased from 5.2 percent to 10.2 percent (Hanson (2010)). During the same period, remittances from the US to Mexico rose from US$2.5 billion to US$21.7 billion, with an average of US$7.5 billion, or 59% of the net FDI (World Bank (2010)). Mexico is the main source of both legal and illegal immigration to the US. In 2004, 56 percent of the 10.3 million Mexicans in the US were there illegally (Passel (2005)). Hence, illegal immigration causes a huge pressure on the US government to limit border crossing (Hanson and Spilimbergo (1999)), drives the political fortunes of US Governors (Hanson (2005)) and stands high on the agenda of every US presidential candidate. Understanding what drives this migration flow is critical for any assessment of future patterns and policy design (Hanson (2006)).

Although recent contributions attribute a large share of this rise in migration to demographic factors (Hanson and McIntosh (2009), Hanson and McIntosh (2010)), much remains to be understood. In the 1990s, the Mexican government implemented various policies that may have affected migration, yet we lack rigorous econometric evidence in this respect (Hanson (2006)). We contribute to the literature by showing that changes in land property rights in the 1990s did affect migration to the US.

The research questions are, is there a relationship between land property rights and Mexico-US migration? If there is, do better defined property rights slow down or speed up migration flows?

In order to identify the impact of property rights on migration behavior, we make use of the land certification program *Procede*, which was implemented throughout the 1990s and targeted all ejido land in the country. Ejidos are areas of land allocated in usufruct to groups of farmers, called ejidatarios, and cover about 60 percent of all agricultural land in the country (Velez (1995)). *Procede* provided households with certificates for their housing plot, their individuals plots, and their right to use the common land. By providing certainty over their rights, the certificates may have led households to relocate their labor supply in favor of off-farm activities, like migration. In order to account for potential omitted variable bias, we

exploit program timing and households' eligibility for the program. Comparing eligible and ineligible households, we find that the program increased the likelihood of having one or more members abroad by 12 percent. In terms of number of migrants, our coefficient estimates explain 31 percent of the 1994-1997 increase in Mexican migrants from ejido areas and 16-18 percent of the increase from the entire Mexico.

The paper also contributes to the literature on land property rights and titling programs, and to the literature on international migration. Concerning the latter, in his recent survey, Hanson (2010) argues that, notwithstanding the recent rise in global migration, it is very challenging to reconcile the level of global migrants (about 3 percent of the global population) with large and persistent wage differentials across countries. This is even more puzzling in the case of Mexico, where borders are porous and illegal migration is widespread. Hanson (2006) calculates that at the existing wage rates (confirmed by Rosenzweig (2007)), it takes less than two months for a migrant with 5-8 years of education to recoup the costs of crossing the border.

There are two sets of explanations. First, cross-country wage differentials may be lower than the average earning differences if migrants' self-selection is positive. This may not apply to Mexico as Chiquiar and Hanson (2005) find that selection there is intermediate.[1] Second, there must be large unobserved costs of migrating other than the cost of crossing the border. However, rather than identifying these costs, the literature has focused on the cost-mitigating role of networks at the destination (see Munshi (2003) and McKenzie and Rapoport (2010) and references therein). The present paper contributes to this literature by identifying a strong yet neglected determinant of migration: tenure (in)security. Tenure insecurity may have induced household members to stay home in order not to lose their land inheritance. Moreover, it may have reduced the incentive to use migration as a self-funding strategy to send money back home (Woodruff and Zenteno (2007), Yang (2008), Mendola (2008)).

We also contribute to the literature on land titling programs. In the last decade, research has mainly aimed at estimating the impact on investments (see Pande and Udry (2006),

[1] Evidence is not conclusive though; see Orrenius and Zavodny (2005), Mishra (2007), Ibarraran and Lubotsky (2007), Fernandez-Huertas (2010), Caponi (2006) and McKenzie and Rapoport (2010).

Deininger and Feder (2009), and Galiani and Schargrodsky (2010b) for excellent reviews), whereas "the relationship between land tenure and off-farm labor market participation is under-researched, especially in rural areas of developing countries" (Deininger and Feder (2009):256). For urban areas, the evidence is mixed. Field (2007) finds a positive impact on labor supply outside the home among urban squatters in Peru, while Galiani and Schargrodsky (2010a) find no impact among urban squatters in Buenos Aires. Whether urban property rights have an impact on labor supply outside the home may depend on whether the labor supply was constrained prior to the change in property rights (Galiani and Schargrodsky (2010b)). For rural areas, Do and Iyer (2008) find a positive impact on off-farm labor supply among rural households in Vietnam, although it is ten times smaller than the impact identified by Field (2007).[2] To our knowledge, there is no evidence on the impact of land certification on migration, which is the natural extension of the study of non-farm labor participation. Since Mexican household members can now leave (and even rent out) their land without fear of being expropriated or fear of losing their inheritance, they may be able to migrate to higher-income work, which may imply urban areas or, in our case, the US.

The major added value of the paper is the identification strategy. Property rights are typically endogenous to household behavior (Besley and Ghatak (2010)). In order to tackle the corresponding identification challenge, we take the following steps. First, we consider a land certification program that provides a neat source of discontinuity in (de facto) property rights between certified and non-certified communities. Second, we use survey data on the same households prior to the program to control for all unobserved time-invariant differences between program and non-program areas that may be correlated with migration behavior.

Third, we control for unobserved time-varying differences between program and non-program areas, which may still be correlated with migration behavior, by using an additional control group (non-eligible households) and employing a DDD strategy.[3] This identification strategy is what distinguishes the present paper from Mullan, Grosjean, and Kontoleon (2011)

[2] Field (2007) finds an increase equal to 3.04 working hours outside the home per week per working household member, while Do and Iyer (2008) find an increase equal to 0.36, almost ten times smaller. In the latter paper there is no descriptive statistic on labor supply before (and after) the program, so we cannot speculate on the extent to which the labor supply was constrained.

[3] See Field (2007) for a similar approach.

and de la Rupelle, Quheng, Shi, and Vendryes (2009), who look at rural-urban migration in China, and de Braw and Mueller (2009), who look at internal migration in Ethiopia. In contrast to them, we use a land certification program (and a DDD strategy) to identify the causal impact of land property rights on migration, rather than self-reported tenure security or land transferability.

The paper is structured as follows: Section 2 describes the certification program and land property rights in Mexico; Section 3 discusses the theory linking land property rights to household migration behavior; Section 4 presents the data, the identification strategy, and the regression specification; Section 5 presents the results; and Section 6 concludes the paper.

2 Context: *Procede* in Mexican ejidos

Following the 1911 revolution, the Mexican government established that groups of farmers could free of charge receive non-transferable land in usufruct.[4] The ejido is the agrarian institution that is endowed with such land and which is generated with this application (Quesnel (2003)). The ejidatarios are the farmers who applied for such land. They could decide whether to divide part or all of the land into individual plots.[5] Each of them received one individual plot and access to the common land. Individual plots were used mainly for rainfed agriculture, while common land was used mainly for cattle and livestock grazing (Procuraduaria Agraria (2010)).

Throughout the decades ejidos arrived to include an estimated 3.2 million ejidatarios in about 30,000 ejidos and to constitute 56 percent of the national land usable for agriculture (World Bank (1999)).[6] Ejidos became characterized by levels of capital endowment significantly lower than in the private sector (World Bank (2001)) and by extreme poverty (Velez (1995)).

[4] Article 27 of Estados Unidos Mexicanos (1917).

[5] Details can be found in Estados Unidos Mexicanos (1971). See articles 130, 134 and 135.

[6] The remaining land used for agriculture is private property and is not considered in our empirical application.

The 1992 Agrarian Law grants ejidatarios full property rights to their urban plots, the rights to sell (exclusively to members of the same ejido) and rent out their individual plots,[7] and the right to use the common land, but not to transfer it.[8]

The law confirms the use rights on all plot types and introduces the transfer rights on urban and individual plots. In addition, it introduces the rights to use wage labor and to leave the individual plots fallow for more than two years.[9] The limits to the right to sell imply the virtual impossibility to collateralizing land to obtain credit.[10]

At the end of 1993 the government launched a massive certification program, called *Procede*. As part of the program, ejidatarios' rights over land were documented with certificates issued by the National Agrarian Registry (RAN).

Certificates for individual plots (*certificado parcelarios*) included the name of the ejidatario, the size and position of the plot, and the list of bordering neighbors. The certificates replaced the old certificates (*certificado de derechos agrarios*), which included only the name, the ejido affiliation, and the way of acquisition of the plot (Del Rey Poveda (2005):162,166). Certificates of access to common land reported the ejidatario's name and the proportion of the common land he/she had the right to use.

Procede aimed to provide certificates to all ejidatarios, i.e., they were all *eligible* for the program. Non-eligible landed households in the ejidos were households with no formal rights to land, either because they had no blood ties with the farmers in the ejido or because they had blood ties but the household head did not inherit the land. This group came to possess land through occupation of empty plots or acquisition through black markets, and arrived to constitute 37.2 percent of agrarian subjects (World Bank (2001):13-14). They did have the

[7] See articles 68, 79 and 80 of Estados Unidos Mexicanos (1992).

[8] Only the ejido Assembly, in case of majority of votes, has the right to transfer the common land. Such right is limited to the common land as a whole and to companies external to the ejido (art.75) and does not seem to have been used in practice.

[9] Details of ejidatarios' rights can be found in Estados Unidos Mexicanos (1971). For rights on urban plots, see article 93. For rights on individual plots, see articles 52, 55, 77 and 85. Possible exceptions are listed in article 76. For rights on common land, see article 67.

[10] A plot can be used as collateral only with credit institutions that already have commercial relationships with the ejido, and, in case of default, the credit institutions can seize the plot only for the amount of time necessary to get the money (Art. 46). So, we do not expect certificates to have increased access to credit. Acquisition of full property rights (*dominio pleno*) requires an additional deliberation of the Assembly and an individual application of the ejidatario to the RAN (Art.81-82). In practice, very few Assemblies seem to have done so. Only 6/248 ejidos in our sample have adopted dominio pleno.

right to buy one urban plot (but not to trade it further), which made them eligible for the housing title, but no right to individual or common land, making them *non-eligible* for the certificates.

Rather than simply imposing the program on the communities, government officials visited and informed them. Adoption required the consent of a large majority of ejidatarios.[11] The issuance of certificates was relatively successful. *Procede* resulted in the issuance of "certificates to more than 3 million households" (World Bank (2001)).

The certification constituted a *de facto* change in land property rights (as opposed to a *de jure* change), because, rather than providing rights, it improved ejidatarios' ability to take advantage of their formal property rights.[12]

3 Theoretical framework

How can we expect better land property rights to affect migration? The seminal paper by Besley (1995) and the recent survey by Besley and Ghatak (2010) provide a simple framework which, applied to our context, suggests that better property rights unambiguously increase investments via less fear of expropriation (by the state and by other households) and gains from trade.[13] International migration is a highly remunerative type of off-farm labor supply. A simple extension of this argument to include off-farm labor supply predicts a decrease in off-farm labor supply if investments are labor-intensive (e.g., manure, land clearing, and adoption of labor-intensive crops) and an increase if investments are capital intensive (e.g., machinery,

[11] Estados Unidos Mexicanos (1992) describes the adoption procedure in detail. The beginning of the certification program required the head of the village (Comisario Ejidal) to call for the "Information and Consent Assembly". This assembly required the presence of the simple majority of ejidatarios (first call), or any number of them (successive calls), to be valid (art.26). It also required the approval of the simple majority of them to allow officials to map the ejido (art.27). After the measurement took place, the head of the village had to call for the "Delimitation, Assignment and Entitlement Assembly". This assembly required the three fourth of ejidatarios (first call), or its simple majority (successive calls), to be valid (art.26). It also required the approval of two thirds of them (art.27) for the map to be sent to the cadastre (RAN) to be registered. The program terminated when the ejidatarios received the certificates from the cadastre.

[12] Differently from the certification program, the 1992 Agrarian Law applied immediately to all ejidatarios, independently from the possession of the new certificates. Article 4 Transitorios states that ejidatarios in non-program areas maintain their status and can take advantage of the provisions of the 1992 Agrarian Law.

[13] A third channel, collateralizability of land, does not seem to be at work in our context (section 2).

fertilizer, and cattle).[14]

In this paper we formalize an additional mechanism recently suggested by Galiani and Schargrodsky (2010a): the fear of expropriation from within the family.[15] Before the 1992 Agrarian Law, ejidatarios transmitted rights over land only through inheritance. The heir had to be unique, but the ejidatario could choose him/her by stating an order of preference. If he did not do so, the law gave priority to the wife/husband and then to the children, where the order among the latter was left unspecified. If the inheritance went to the children, the ejido assembly intervened to determine the heir.[16] When doing so, the assembly took into account the ability and willingness of the (potential) heir(s) to take charge of the inheritance (Del Rey Poveda (2005):163,173).

This encouraged strategic behavior by the potential heirs (Del Rey Poveda (2005):182). Signaling an ability to take charge of the land and a willingness to remain in the ejido constituted an incentive against migration, since leaving was a clear signal of weak attachment to the land (Del Rey Poveda (2005):170,184). This is consistent with anecdotal evidence from Western Mexico:

> The child who looks after the parents until their death develops certain rights to the property. This may sometimes lead to awkward situations among brothers and sisters who do not want one sibling to look after their parents too much and in this way create claims to the land. (..) Alternatively, a son who has migrated to the United States and declares that he does not intend to come back, may be replaced as heir by a son in the village. (Nuijten (2003):486).

The 1992 Agrarian Law maintains the same inheritance rule with one caveat: potential heirs have three months to find an agreement or the Agrarian Tribunal (rather than the ejido

[14] This channel refers to migration as a self-funding strategy, which is supported by evidence of a positive impact of migration (or remittances) on agricultural technology (Mendola (2008)), household investments (Yang (2008)), and entrepeneurship (Woodruff and Zenteno (2007)). See also de Janvry, Gordillo, and Sadoulet (1997) for a description of the migration-subsistence strategy of Mexican farmers.

[15] "The lack of titles may also impede the division of wealth among family members, forcing claimants to live together to enjoy and retain usufructuary rights" (Galiani and Schargrodsky 2010:708).

[16] See articles 81 and 82 of Estados Unidos Mexicanos (1971).

assembly) will proceed to sell the land within the ejido and split the revenue among the children in equal shares (Del Rey Poveda (2005):163; Riveros Fragoso (2005):44).[17]

There is strong evidence that resorting to the Agrarian Tribunal to settle disputes over land inheritance was a feasible option. The Agrarian Tribunal dealt with more than 104,000 cases concerning land inheritance out of a total of 315,000 during the period 1992-2005 (Morales Jurado and Colin Salgado (2006):229).[18] Land inheritance is by far the primary issue dealt with in terms of number of cases. Even more interestingly, data from the Procuraduria Agraria show that the number of land inheritance law cases has increased dramatically in ejidos that implemented the program (Figure 1).

Thus, certification improves access to courts; potential heirs can now contest land inheritance through outright negotiation in the shadow of the Agrarian Tribunal and no longer have to be present in the ejido. A simple way to capture the influence of better property rights on off-farm labor supply via the land inheritance mechanism is to consider a two-period extension of the basic agricultural model (Singh, Squire, and Strauss (1986)),[19] where the decision maker is the single household member rather than the household as a whole.

Household member i allocates his/her labor supply ($\bar{T}$) to in-farm (T_{if}) and off-farm (T_{io}) activities.[20] Let $Y(T_f, L)$ denote the agricultural production given labor supply T_f and land input L. The function $Y : \mathbb{R}^2_+ \to \mathbb{R}$ denotes the agricultural technology. Assume that

Assumption 1. *Y is continuous, twice differentiable, increasing and concave in each argument with* $\lim_{T_f \to 0} Y_1(T_f, L) = Y_1(0, L) = \infty$.

[17] See articles 17 and 18 of Estados Unidos Mexicanos (1992).

[18] The importance of the definition of the heirs is confirmed by the HEREDA program (Procuraduaria Agraria (2007):169). The HEREDA program started in 2001 and aims at letting all household heads write down a will.

[19] See Chiappori and Donni (2009) for a review of the literature on non-unitary household models. See Browning et al. (2006) for a comparison between unitary and non-unitary household models. Within the migration literature, see Rapoport and Doquier (2006) for a review of the literature on migration and remittances using non-unitary household models.

[20] Off-farm activities include local off-farm activities, domestic migration, and international migration. As long as temporary and return migration are relatively common and the time horizon is medium rather than short, international migration may be considered a continuous choice.

We abstract from the presence of leisure to keep the model mathematically tractable. We also abstract from any distinction between in-farm (productive) labor and guard (unproductive) labor. This is motivated by the fact that: i) guarding is this case is just a signal and does not require specific time or effort; ii) any distinction would be unobservable at the empirical level (in a rural context).

In the first period all household members pool their in-farm labor supplies $\left(T_f = \sum_i T_{if}\right)$. In return, each of them receives an equal share of the agricultural product: $\frac{1}{N}Y(T_f, L)$. In the second period, only the member who captured the land can devote in-farm labor supply to it $(T_f = T_{if})$. In return, he/she received the entire agricultural product: $Y(T_f, L)$. Let w denote the return from each-unit of labor supply devoted to off-farm activities[21].

We assume that household members can influence future land allocation by working in the in-farm activity. The idea is that working the land strengthens the claims over it[22]. On the other hand, an eventual dispute could be settled through a court, be it an Agrarian Tribunal or a less formal local village council. The ability of courts to intervene and settle the dispute increases with land property rights (θ). Weak property rights over land leave room for expropriation from other households (E).

Define the winning probability of member i as a function of own in-farm labor-supply (T_{if}), others' in-farm labor supplies $(T_{kf}$, with $k \neq i)$, external labor supply (T_E) and land property rights (θ) in the following way:

$$p^i = \begin{cases} p\left(\frac{f(T_{if1})}{f(T_{if1})+\sum_{k\neq i} f(T_{kf1})+f(T_E)}, \theta\right) & if \quad f(T_{if1}) + \sum_{k\neq i} f(T_{kf1}) + f(T_E) > 0 \\ p\left(\frac{1}{N}, \theta\right) & otherwise \end{cases},$$

where $p_1 > 0, p_{11} < 0, p_2 > 0, p_{22} < 0$, and $p_{12} < 0$. The first argument corresponds to a rather general contest success function, where $f' > 0$ and $f'' < 0$ (see Skaperdas (1996) for an axiomatization and Garfinkel and Skaperdas (2007) for a review of the literature). The key assumption is that labor supply and property rights are substitutes in the land dispute.

[21] Clearly, when we consider migration w is the return net of all variable costs. Such costs are expected monetary and non-monetary, where the non-monetary component can be substantial (Hanson (2010)). In case of international migration there is also a substantial fixed costs. This is trivial to add to the model and it will be considered in the empirical analysis.

[22] Since we don't model heterogeneity across members of the same households, if they do not contest the land their payoff is homogeneous across members. This could be interpreted either as equal probability of inherit the land or equal division of the land inheritance. The latter could take place either directly by division of the land, or indirectly through assignment of the land to the heir and monetary compensation to the others.

It would be possible to include some degree of heterogeneity across members through the contest success function. This could account for specific inheritance rules like primogeniture. However, this would not alter the qualitative prediction of the model.

This assumption captures the idea household members' access to courts is increasing with the available documentation.

The timing is the following:

- all household members choose simultaneously their labor supply allocation (T_{if1}, T_{io1});
- nature chooses the heir with probabilities p^i;
- the heir allocates his/her labor supply (T_{if2}, T_{io2}).

The generic member's decision problem in the first period is:

$$\max_{T_{if1}, T_{io1}} \frac{1}{N} Y(T_{if1} + \sum_{k \neq i} T_{kf1}, L) + wT_{io1} + \delta \left\{ p^i \left[Y(T_{if2}, L) + wT_{io2} \right] + \left(1 - p^i\right) w\bar{T} \right\}$$

$$s.t. \begin{cases} T_{if1} + T_{io1} = \bar{T} \\ T_{if1}, T_{io1} \geq 0 \end{cases}$$

In case i becomes the heir, his/her decision problem in the second period will be:

$$\max_{T_{if2}, T_{io2}} \left\{ Y(T_{if2}, L) + wT_{io2} \right\} \text{ s.t. } \begin{cases} T_{if2} + T_{io2} = \bar{T} \\ T_{if2}, T_{io2} \geq 0 \end{cases}$$

It turns out (see the Appendix for a detailed analysis) that whoever captures the land finds worthwhile to devote some labor to it. This makes competition for the land asset salient in the first period, which is when the strategic interaction takes place. In equilibrium all members devote the same amount of in-farm labor-supply and this amount is positive.

Concerning the relationship between (first-period) labor-supply and land property rights, the following result applies:

Proposition 1 *Suppose that assumption 1 holds. Then household members' in-farm labor-supply is decreasing in land property rights, while household members' migration is increasing*

in land property rights[23]*:*

$$\frac{dT^*_{fi1}}{d\theta} < 0 \text{ and } \frac{dT^*_{oi1}}{d\theta} > 0.$$

Since the proposition applies to each household member, it applies implicitly to the household as a whole: $\frac{dT^*_{f1}}{d\theta} < 0$ and $\frac{dT^*_{o1}}{d\theta} > 0$.

4 Data and estimation method

4.1 Data

We consider the 1994 and 1997 ejido surveys. The 1994 survey was carried out by the Mexican Ministry of Agrarian Reform (Segreteria de Reforma Agraria, SRA) in collaboration with University of California Berkeley and is designed to be nationally representative of all ejidos (and communities) in Mexico.[24] The 1997 survey was carried out by the Ministry of Agrarian Reform with the World Bank following the same survey design as in 1994. The surveys provide information on 1,286 panel households.[25]

The surveys provide detailed information on household members' demographic characteristics, past migration experiences, current migration experiences of children of the household head living outside the house, use of land, equipment, and ejido characteristics.[26]

[23] If the members' equilibrium in-farm labor supply happens to be a corner solution ($T^*_{if1} = \bar{T}\ \forall i$), then in-farm labor (migration) is weakly decreasing (increasing) in land property rights.

[24] The survey is representative at the state level. Ejidos were selected from each state except Chiapas, where conflict prevented fieldwork. Details can be found in de Janvry, Gordillo, and Sadoulet (1997).

[25] The attrition rate was only 4.0%. See World Bank (1999): Annex 2 for details. The program started between 1993 and 1994, i.e., only a few months before the 1994 survey, which was conducted during the summer. We exclude 14 households as they belong to ejidos with missing information regarding the program, 108 households as they belong to ejidos that completed the program before the 1994 survey, 15 households because they are private landowners, 113 households due to unclear status (to be specified later), and 110 households because they belong to communities instead of ejidos. The final sample has 926 households in 221 ejidos.

[26] These data have been used by several other authors for a variety of purposes: ejido reforms (World Bank (1999), World Bank (2001), Munoz-Pina, De Janvry, and Sadoulet (2003), migration (Winters, de Janvry, and Sadoulet (2001); Davis and Winters (2001)), off-farm activities (de Janvry and Sadoulet (2001)) and cash transfer programs (Sadoulet, Janvry, and Davis (2001)).

4.2 Migration to the United States

Mexicans started migrating to the US from rural areas following the construction of railroads in the early 20th century and the Bracero program from 1942 to 1964 (Hanson 2006). De Janvry, Gordillo, and Sadoulet (1997) show that the variation in migration experience among ejidatarios' cohorts is consistent with them having been part of this migration flow. Out-migration is historically high in the northern and central regions. These regions also constitute the primary location of ejidos; our final sample of ejido households is located primarily in the central (29.48%) and northern (22.57%) regions, followed by the Gulf (17.28%), south Pacific (16.95) and north Pacific (13.71%) areas. The distribution of ejido households across Mexican states is positively but not perfectly correlated with the 1994 population distribution for the entire Mexico (the state-level correlation is 0.44). In turn, state migration rates are positively correlated with the distribution of ejido households (0.30) but not with the population distribution (-0.02).[27]

In order to identify migrant households we construct a binary indicator taking the value one if any household member who is currently living at home has been in the US within the previous three years or if any child of the household head currently lives in the US. Migrant households amount to 15 percent in 1994 and 29 percent in 1997. The average number of migrants per household is 0.3 in 1994 and 0.72 in 1997. These migration rates are consistent with Winters, de Janvry, and Sadoulet (2001) for 1994 and with Davis and Winters (2001) for 1997. The increase in the number of migrants from 1994 to 1997 (0.420) corresponds to about 1,384,281 additional migrants (both temporary and permanent).[28] U.S. Immigration and Naturalization Service (2003) provides some yearly estimates of the number of illegal Mexicans who entered the US during the period 1990-1999; the number of additional migrants for the period 1994-1997 is 1,873,000 illegal entrants. These estimates rely on assumptions

[27] Conteo de Poblacion y Vivienda (1995). Own tabulations. Migration is defined as the share of the population that migrated to the United States within the previous five years.

[28] The number of additional migrants is obtained by multiplying the number of ejidos (26,796, according to World Bank 2001) with the average number of landed households per ejido (123) and the increase in the number of migrants per landed household (0.420). Using the estimates in Winters and Davis (2001), one obtains 875,184 additional migrants, perhaps because they include "comunidades", which typically have low migration rates.

of under-counting and should be used cautiously. According to Hanson (2006), the true flow could be 15 percent higher than the estimate reported by INS, i.e., 2,153,950 entrants. During the same period, the number of legal Mexican migrants was 511,883 (U.S. Immigration and Naturalization Service (1999)). Hence, the total number of migrants is between 2,384,883 and 2,665,883. Based on these estimates, the 1994-1997 increase in the number of migrants from Mexican ejidos corresponds to 52-58 percent of the number of Mexicans who entered the US. This is consistent with migration stemming primarily from rural areas and ejido households constituting a large fraction of the rural population.[29]

4.3 Identification strategy

In this paper we exploit both the timing of the certification program and heterogeneity in farmers' status within ejidos to identify the impact of the program on household migration behavior. The 1997 ejido survey contains detailed information on the implementation of the program. Ejidos that completed the program before the 1997 survey are termed "program areas," whereas those that did not are termed "non-program areas." Households in non-program areas constitute our first control group. Ejidatarios in program areas benefit from the program as they receive the certificate for their houses and their individual plots as well as for access to common land.[30]

Program timing may be far from randomly allocated: government officials may have implemented the program according to ease of entry; the decision to implement the program by the ejido assembly may have suffered from collective action problems and from the resolution of internal land conflicts. Table 1 shows the self-reported explanations for the decision to implement or not implement the program. As can be seen, the primary reason to implement the program was tenure security (88.3%), followed by willingness to solve border issues

[29] According to de Janvry (1995) ejidos include 70 percent of all Mexican farmers.

[30] In the 1997 ejido survey, 13% of ejidatario households in program areas report no *Procede* certificate for their individual plots. An additional 9% report to have receive *Procede* certificates for some but not all their plots. The (unobserved) reasons could be the following. First, some of the certificates might have not arrived yet. This is consistent with relatively low certification rates in ejidos certified in 1997 and in ejidos where the date of reception of the certificates is missing. Second, households may own land in ejidos, different from the one they live in, which have not been certified yet. Partial and delayed certification makes the estimation of the LATE of the certificates problematic.

(29.7%); the primary reason not to implement the program was lack of information (30.4%), tax avoidance (15.9%), and border issues (15.9%). Overall, these explanations are certainly interesting, yet the only surprising feature is the small role played by land market motives. We will make use of some of this information later in the analysis.

In Table 2 we compare some observable ejido characteristics across program and non-program areas prior to the program (Columns 1-3). Program areas have a higher percentage of parceled land relative to common land, less ejidatarios, a more equal distribution of parceled land, better infrastructure (access to paved road, electricity, drinking water and drainage, existence of an assembly hall), and fewer boundary problems. The differences suggest that the program may have been directed to smaller and wealthier ejidos first, which is consistent with World Bank (1999) and World Bank (2001).

Non-random program timing may be problematic if the determinants of program implementation are correlated with household migration behavior. In order to correct for this bias, we could control for ejido characteristics that we found to be correlated with program implementation (selection-on-observables). However, there would be no way for us to be sure of having included all relevant determinants.[31]

In order to improve our identification strategy, we make use of non-eligible households as an additional control group and compare the difference in migration behavior between eligible and non-eligible households in program areas with the difference between eligible and non-eligible households in non-program areas. Let M_i be an indicator for the migration behavior of household i and let P and E indicate program areas and eligible status, respectively. Our baseline comparison is:

$$\{E[M_i|P=1,E=1] - E[M_i|P=1,E=0]\} - \{E[M_i|P=0,E=1] - E[M_i|P=0,E=0]\}.$$

Let $M_i(P,E)$ denote potential outcomes and assume that the program is randomly allo-

[31] Two potential confounding factors are the pre-NAFTA subsidies and migration networks. Entry into NAFTA led to the removal of subsidies to agriculture and, possibly, to out-migration (de Janvry and Sadoulet (2001), Sadoulet, Janvry, and Davis (2001)). This may bias our estimates if pre-NAFTA subsidies differed across program and non-program areas. The same is true for community migration networks (Winters, de Janvry, and Sadoulet (2001), Munshi (2003)).

cated across eligible and non-eligible households:

$$E[M_i(0,1)|P=0,E=1] - E[M_i(0,0)|P=0,E=0] =$$
$$= E[M_i(0,1)|P=1,E=1] - E[M_i(0,0)|P=1,E=0].$$

Then we can re-write (see Appendix) the baseline comparison as:

$$E[M_i(1,1) - M_i(0,1)|P=1,E=1] - E[M_i(1,0) - M_i(0,0)|P=1,E=0].$$

This expression corresponds to the *mean effect of the program on eligible relative to non-eligible households*. Since one of the control groups (non-eligible households in program areas) gets partial access to the program, the potential outcomes within the second part of the expression do not cancel out and the estimator corresponds to a downward biased estimator of the *mean effect of the program on eligible households* (Heckman, Lalonde, and Smith (1999)).[32] Non-eligible households in program areas receive the certificates for their housing plots; they do not receive the certificates for their individual plots unless the ejido assembly recognizes them in their status of possessors (which happens 66 percent of the times); they do not receive the certificates of access to common land unless the ejido assembly upgrades them to ejidatario status (which happens, on average, 34 percent of the cases).[33]

In order to identify eligible and non-eligible households, we make use of pre-program (1994) data on possession of an ejido certificate. Households with a pre-program ejido certificate are termed "eligible," whereas those without are termed "non-eligible."[34] An informal check of

[32] The econometric issue is very similar to control group members having access to a substitute program (Heckman, Hohmann, Smith, and Khoo (2000)) and to a measurement error in "eligibility" status among comparison group members (Heckman, Lalonde, and Smith (1999), Heckman and Robb Jr (1985)). It is not clear whether both mean effects are Intent-To-Treat (ITT) effects or not. For example, in Banerjee, Duflo, Glennerster, and Kinnan (2010), part of control group members access the program and the authors still present their estimator as an ITT.

[33] This share is the outcome of the following back-of-the-envelope exercise: in 1994 there were 87 eligible households in program areas (Table 2); the ratio ineligible-eligible households in program areas in our sample is 0.57, i.e., an average of 50 ineligible households in program areas; from 1994 to 1997 the number of eligible households in program areas increased from 87 to 104, which corresponds to an upgrading of 34 percent of ineligible households.

[34] According to Estados Unidos Mexicanos (1971) (Art. 69) and to Del Rey Poveda (2005):166, ejidatarios' rights are acknowledged by certification (*certificado de derechos agrarios*). Indeed, these certificates constitute

the quasi-random assignment of the program across eligible and non-eligible households is to compare observable characteristics of eligible and non-eligible households across program and non-program areas *prior* to the program. The results (Table 2) show a lack of significant differences across groups (Column 9) in migration rates, household demographics, dwelling characteristics, assets, and land transactions. Besides, even the comparison of each group of households across program and non-program areas (Columns 3-5, 6-8) shows very little differences.[35] Households' pre-program tenure security is unobserved, but there are strong theoretical reasons to expect tenure security to be correlated with the intensity of land transactions (Besley (1995), Besley and Ghatak (2010), and Deininger and Feder (2009)). Table 2 shows that land transactions were relatively widespread prior to the program, and that their intensity does not differ across groups. This is consistent with case studies (Nuijten (2003)) suggesting that informal tenure security was relatively strong and supported widespread black markets.[36]

The 1997 ejido survey also includes information on the date of completion of the program. This will allow us to separate program areas into early (1994-1995) and late (1996-1997) program areas. This differentiation captures the fact that households in early program areas had more time to adjust their migration behavior. It may therefore also be appropriate to compare eligible and non-eligible households across early and late program areas (Table A2 in the online appendix). Notwithstanding the limited sample size, there are remarkably few differences between eligible and non-eligible households across early and late program areas (Column 8).

By using non-eligible households as an additional control group, we control for all differences across program and non-program areas shared by the two groups. Still, it could be that migration behavior differs between eligible and non-eligible households across program and non-program areas due to factors other than the certification program.

One way to relax this identification assumption is to control for household-level charac-

the basis for the delivery of the new certificates (Art.4 Transitorios, Estados Unidos Mexicanos (1992)).

[35] Table A1 (online appendix) confirms the comparability of the two groups across program and non-program areas with 1997 data.

[36] In fact, pre-1992 land transactions were illegal but widely accepted within ejidos (Yates (1981):181, and NACLA (1976):18, cited in Heath (1990):34).

teristics, which we select based on the migration literature. Descriptive statistics comparing migrant and non-migrant households (not reported) show that migrant households are bigger, associated with a greater number of siblings of the household head abroad,[37] less likely to be indigenous, and associated with greater land assets and better dwelling characteristics. On the other hand, their household heads are older and less educated (but equally literate). Average schooling is similar.[38]

Another way to relax our identification assumption is to exploit the time-series dimension of our dataset. By doing so, the identification assumption is that the difference in migration behavior between ejidatarios and non-ejidatarios across program and non-program areas does not vary over time due to factors other than the certification program. Thus, we allow for a difference in migration behavior, but it must be constant over time.

4.4 Regression specification

The model presented in Section 3 predicts that an increase in land property rights causes a decrease in in-farm labor supply and an increase in off-farm labor supply. The prediction is valid both at the individual and household level. In this section we will test the prediction at the household level. Since the household surveys are rich in questions on household members' migration experiences but not on in-farm labor supply, we will focus on the former. The outcome of interest is household migration status (see Sub-section 4.2). As a robustness check, we will also report the results for the number and for the share of migrant members.

We estimate 1997 household migration status with the following Linear Probability Model (LPM):

$$y_{ik} = \eta_1 + \alpha_1 w_i + \beta_1 (w_i * e_{ik}) + \gamma_1 e_{ik} + \Gamma'_{11} Z_{ik} + \Gamma'_{12} (Z_{ik} * e_{ik}) + \Gamma'_{13} X_i + \varepsilon_{1ik}, \qquad (1)$$

[37] The number of siblings of the household head abroad is a proxy for the strength of the household migration networks (Winters, de Janvry, and Sadoulet (2001)).

[38] The absence of selection in terms of education is surprising with respect to the literature on Mexican migration. However, note that the average level of education is very low in our sample (3-4 years of schooling), while Chiquiar and Hanson (2005) show that, in 1990, 73.9 percent Mexican residents had more than four years of education.

where $y_{ik} \in \{0,1\}$ is the migration status of household k in ejido i, $w_i \in \{0,1\}$ indicates whether ejido i completed the program before the 1997 survey, $e_{ik} \in \{0,1\}$ indicates whether household k in ejido i is eligible, X_i is the vector of ejido-level controls, Z_{ik} is the vector of household-level controls, and ε_{1ik} is the error term clustered at the ejido level. We will also estimate the 1997 household migration status using a Logit model[39]. Equation (1) then corresponds to the latent variable specification. The household-level controls (Z_{ik}) are the following: household composition (age of the household head, number of adult members, fraction of females among adult members, average literacy[40], average schooling of adult members[41]), migration assets (number of siblings the household head abroad)[42], and land assets (land used in 1994). The ejido-level controls (X_i) are the following: land (ejido area in logarithm, share of common land with respect to common and parceled land), population composition (dummy for indigenous ejidos, membership to ejido union), and infrastructure (access to paved road).

The identification of the impact of *Procede* on eligible households (β_1) in (1) requires that there is no difference in migration behavior between eligible and non-eligible households across program and non-program areas driven by factors other than the program or the set of controls we include. This specification lets us control for all unobserved differences across program and non-program areas common to both eligible and non-eligible households (α_1), like distance from the border (which affects the cost of migration), historical community networks (which affect both the cost of migration and its expected return), and varying implementation of the program (due for example to administrative capacity of the Procuraduria Agraria across areas).

To address the possibility that the identification assumption does not hold, we exploit the time dimension of our dataset and estimate household migration status according to the following Pooled Linear Probability Model:[43]

[39] The marginal effect of the interaction term is computed according to Norton, Wang, and Ai (2004).

[40] This information is available for members currently living at home only.

[41] Adult household members are at least 15 years old.

[42] Notice that the siblings of the hosuehold head may have been part of the household before migrating. Therefore, our measure of household migration assets in 1997 may be partly endogenous to the program. In order to avoid this possibility, we consider its pre-program (1994) value.

[43] Again, we will also estimate household migration status using a Logit model (following Cornelissen and Sonderhof (2009) to compute the marginal effect associated with the triple interaction term).

$$
\begin{aligned}
y_{ikt} &= \alpha_{21} w_i + \alpha_{22} (w_i * 1997) + \gamma_{21} e_{ik} + \gamma_{22} (e_{ik} * 1997) + \gamma_{23} 1997 + \\
&+ \beta_{21} (w_i * e_{ik}) + \beta_{22} (w_i * 1997 * e_{ik}) + \Gamma'_{21} Z_{ik} + \Gamma'_{22} (Z_{ikt} * e_{ik}) + \varepsilon_{2ikt},
\end{aligned} \tag{2}
$$

where y_{ikt} is the migration status of household k in ejido i at time t, w_i is the dummy for ejidos that received certificates in 1997, and e_{ik} is the dummy for eligible households. The identification of the impact of *Procede* on eligible households (β_{22}) requires that the difference in migration behavior between eligible and non-eligible households across program and non-program areas, due to factors other than the program and the included controls, is constant over time. This assumption is weaker than the previous one, because now we control also for time-invariant unobserved differences between eligible and non-eligible households across program and non-program areas (β_{21}).

5 Results

5.1 Impact of *Procede* on migration

Table 4 shows the results associated with the cross-section specification (1). Without controlling for any background characteristics, the coefficient estimate associated with eligible households in program areas is positive and large (0.115), but not significant at conventional levels. We then control for background characteristics (Column 2): the coefficient is now larger (0.127) and marginally significant. The marginal effect associated with a Logit model (Column 3) has similar magnitude (0.119) and is also marginally significant. The result is robust to the use of alternative dependent variables, such as the number of migrants (Column 4) and the ratio of migrants to adult household members (Column 5).

The direction, magnitude, and significance of the coefficients associated with the control variables are quite consistent with basic economic theory; i.e., the opportunity cost of migration decreases with household size if agriculture is characterized by decreasing marginal

returns (each additional adult increases the likelihood of migrant status by 3 percent), and cultural barriers and geographical distance from the US are associated with less migration (the coefficient associated with indigenous ejidos is negative in all specifications).

In order to find out the seriousness of the concern for endogenous selection into the program we restrict the sample to non-eligible households who did not receive any certificate and estimate a difference-in-difference model comparing program and non-program areas before and after the introduction of the program. Table 5, Panel A, shows the results: the coefficient associated with non-eligible households in program areas is negative, small, and insignificant (between -0.035 and -0.062).

Table 5, Panel B, shows the results associated with the panel specification (2). The coefficient estimate associated with eligible households in program areas is positive, large, and significant or marginally significant in all specifications (Columns 1-8). Since households in early program areas (1994-1995) had more time to adjust their migration behavior than households in late program areas (1996-1997), we re-estimate some of the specifications using program timing, which takes the value 1 for late program areas and the value 2 for early program areas (Columns 8-10). The coefficient estimate is positive and significant, and its magnitude is consistent with the baseline estimates. Note that the magnitude, which ranges from 0.112 to 0.129, is remarkably similar to the one associated with the cross-section specification, which suggests the absence of any unobserved time-invariant difference in migration behavior between eligible and non-eligible households across program and non-program areas.[44] The coefficient estimates associated with non-eligible households in program areas (program*1997) and eligible households in non-program areas (eligible*1997) are much smaller and generally insignificant, which is also reassuring[45].

A coefficient estimate of 0.12 is very large. It constitutes an increase in migration rates

[44] As a robustness check, we re-estimate specification (2) controlling for non-land household assets that had shown some differences across groups in Table 3. Since they may be affected by the program, we include pre-program assets in levels and interacted with the time dummy. Table A3 shows the results: the coefficient of interest is robust to these additional controls (0.112-0.118), although we lose some precision in some of the specifications.

[45] We also estimated a DD specification with sample restricted according to eligibility status. Table A4 shows the results for eligible households (Panel A), ineligible households (Panel B) and without distinction in terms of eligibility (Panel C).

of 80 percent relative to the 1994 average migration status (0.15) and 85.7 percent relative to the 1994-1997 time trend (0.14). Since eligible households in program areas are 32.2 percent of the entire sample, our coefficient estimate explains 27.6 percent of the overall 1994-1997 increase in migration. The land certification program appears to have had a profound impact on ejidatarios' migration behavior. In terms of number of migrants, our coefficient estimates correspond to 429,238 additional migrants.[46] As discussed in Sub-section 4.2, the number of migrants from Mexican ejidos during the period 1994-1997 equaled 1,384,281 people, while the number of Mexican migrants ranged between 2,384,883 and 2,665,883 people. Hence, the coefficient estimates explain 31 percent of the increase in Mexico-US migration from the ejido sector and 16-18 percent of the entire Mexico-US migration.

This magnitude can be explained in terms of great initial tenure insecurity. However, it is also consistent with the coefficient capturing part of the legal changes introduced with Estados Unidos Mexicanos (1992) (see Section 2). This would be the case if, for example, eligible households in non-program areas were not aware of such legal changes or presumed that they were conditional on the certification. In this case the impact of the program would capture not just a de facto change in property rights, but also a de jure one.

We know that implementation of the program required the substantial resolution of border issues within eligible households and between eligible and non-eligible households. Thus, one may worry that our selection into the program may be affected not just by the eligible households, but also by non-eligible households. If so, our identification strategy would fail to control for unobservable characteristics that could, in principle, be correlated with household migration behavior. We therefore re-estimate specification (2) excluding all the households within ejidos that report to have implemented (or failed to implement) the program to solve border issues or conflicts between eligible and non-eligible households. Table A5 shows the results: the coefficient associated with eligible households in program areas is positive, large, and marginally significant in all specifications. The magnitude is similar (slightly higher) as previously found: it ranges from 0.134 to 0.155. Thus, we find no evidence that this particular

[46] This magnitude is the result of the following expression: 26,796 (ejidos, according to World Bank 2001) *111/211 (share of program areas) *87.01 (average number of eligible households) *0.350 (impact on the number of migrants).

selection mechanism drives our results.

Finally, note that our theoretical model generates a prediction that may be applied not just to international migration but also to domestic migration and off-farm labor within the village. So far our analysis has focused only on the first margin. There are two reasons for this. First, the impact on international migration is arguably the most interesting among the three. Second, the survey was designed with a particular focus on international migration, whereas the emphasis on off-farm labor was not as strong. As regards domestic migration, we know whether household members migrated to another state. However, it is not possible to tell whether they migrated to an urban area within the same state or remained in the same village. Regarding off-farm labor supply, it would be desirable to know the number of in-farm and off-farm labor hours (like in Field (2007) and Do and Iyer (2008)). To this end, we will have to rely on the information about the primary and secondary occupation of household members living at home. Specifically, we estimate the impact of the program on non-agricultural status, i.e., at least one member currently living at home works outside agriculture. Table A6 shows the results: the coefficient estimate of interest is negative and never significant, and its magnitude varies across specifications. Thus, we find no evidence of an impact on off-farm labor for members currently living at home. This could be driven by measurement error in the dependent variable or simply be due to international migration absorbing the entire impact of the program on off-farm labor.

A subtle negative general equilibrium effect of the program has to do with social cohesion within the community. Community cohesion implies non-monetary ties that prevent people from migrating abroad (Hanson (2010)). The program may have damaged such cohesion. This would not bias our parameter estimate of interest if both eligible and non-eligible households were affected in the same way, while it could bias the coefficient upwards if eligible households were affected more than non-eligible ones. Fortunately, our community and household questionnaire includes a question on the effects of the program on social cohesion (only for program areas), reading: "If the ejido implemented the program, how has the program affected social cohesion? (more, same, less)." The fact that social cohesion was not affected

(67.77%) or even increased (22.51%) and that these percentages are identical across eligible and non-eligible households is reassuring.

5.2 Do differences in migration behavior reflect anticipatory responses to the program?

One may wonder whether the certification process may have led households to postpone their migration decision rather than having increased the incentive to send one or more household members abroad. For example, it could be that household members feared being left out from the certification process and therefore waited for the certificate to reach the household before deciding to migrate. It could also be that household members abroad returned home just before the program started to ensure that they would not lose future assets, and then went abroad again. If this were the case, we would be confounding a short-term behavioral response to the program with a structural change in the households' migration strategy. In terms of tenure security, we would mistakenly take short-term tenure insecurity generated by the program itself for a permanent increase in tenure security.

In order to rule out this possibility, we make use of future timing in specification (1) using the 1994 household survey. If there is anticipatory behavior, then households in early program areas should migrate less than households in late program areas. Table 6, Panel A, shows that the coefficient estimates associated with this exercise are insignificant and very close to zero, regardless of whether we consider program relative to non-program areas (Columns 1-6) or soon-to-be-certified areas (certified August-December 1994) relative to all others (Columns 7-9), and whether we add controls, use a non-linear model or alternative dependent variables.[47]

Second, the 1997 community questionnaire identifies non-program areas that have initiated but not completed the program (henceforth *in-process* areas). In contrast to the 1994 soon-to-be-certified areas, we do not know when the 1997 in-process areas will complete the program or whether they will do so before the areas that have not yet started it. If this distinction between non-program areas runs along the lines of some unobserved characteristic other than

[47] The results are similar if we extend the time window for soon-to-be-certified areas to ten months (August 1994 - May 1995).

the timing of the program, then our previous identification assumption does not guarantee the correct identification of the impact of the program on in-process areas or the impact of the program on program areas. Keeping this caveat in mind, we estimate the panel specification. Table 6, Panel B, shows the results: the coefficient estimate associated with eligible households in in-process areas is negative, relatively small, and insignificant; the coefficient estimate associated with eligible households in program areas is generally consistent with the previous findings, although slightly smaller, and not always precisely estimated.

Overall, anticipation issues do not seem to explain the evidence gathered so far, although we cannot exclude that they did play a minor role.

5.3 Impact heterogeneity and the inheritance channel

Impact heterogeneity may be used to identify the channel(s) through which the property rights-migration relationship takes place.[48] In Section 3, we suggested the land inheritance mechanism, i.e., uncertain property rights keep landless family members home as they fear to lose their land inheritance in case of departure.

In order to test this mechanism, we divide households depending on whether the household head has written a will and re-estimate specification (2) for each sub-sample. The program should have a strong impact on households with no will, as it reduces the relatives' need to stay home to defend their informal property rights over the land inheritance (since the certificate allowed them access to the Agrarian Tribunal to solve any dispute). Yet, we expect the program to have little or no impact on households with a will, as the identity of the heir is known and there is less room for dispute. Any competing rationale (Section 3) would have difficulties explaining heterogeneity of the impact of land property rights across households with and without a will. Table 7 shows that, in support of the inheritance mechanism, the coefficient of interest is positive, large, and significant among households without a will (Column 3: 0.147), while it is small and insignificant among households with a will (Column

[48] In the working paper version we also explore the impact heterogeneity with respect to land assets.

2: 0.039).[49]

It is important to recognize that such evidence is not conclusive. We do not know why some households have a will and some do not. Del Rey Poveda (2005:185-186) argues that household heads may avoid writing a will to reduce their children's willingness to migrate. This concern does not seem very problematic, as it may work as an attenuation bias.

A more serious concern is whether the program led households to write a will. There is anecdotal evidence suggesting that, while implementing the program, officials suggested that households deposit a will (Del Rey Poveda (2005):179). If eligible household heads with low propensity to migrate wrote down a will following the program to a larger extent than non-eligible household heads did, then the coefficient estimate associated with households with a will (Column 2) is downward biased, while the coefficient estimate associated with households without a will (Column 3) is upward biased. Fortunately, this is not what our data suggest. The distribution of wills across households (in 1997)[50] is 25% and 34% respectively for non-eligible and eligible households in non-program areas, and 45% and 37% respectively for non-eligible and eligible households in program areas. Thus, it seems that the program led more non-eligible household heads to write a will than eligible ones, rather than the other way around. If the decision to write a will was somehow related to migration behavior, it would have to work like an attenuation bias. Nonetheless, we know too little about the determinants of the decision to write a will (and our data do not allow for much more than what we do here), and hence we interpret the evidence in Table 7 as an interesting correlation rather than as conclusive evidence.

In Table A7 we look at two other potential channels: land rental transactions (Panel A) and wage non-family labor (Panel B). In both cases the outcome is a binary variable indicating whether the household has been involved in a land transaction within the previous three years, and whether the household has hired non-family labor within the previous 24 months. In both cases, the coefficient estimate of interest is always small and never significant.[51] Another

[49] It is also consistent with a slightly different rationale (included in the model in Section 3), i.e., rather than attenuating the competition among potential heirs, land property rights attenuate the fear of expropriation by other community members.

[50] The information about households' will is only available for 1997.

[51] The results are the same if we consider the number of land rental transactions.

outcome it would be interesting to consider is land sales transactions, but they are too few in our sample to even try to estimate a model. Thus, we find no evidence supporting channels other land inheritance.

6 Conclusion

In this paper we ask whether there is a relationship between land property rights and international migration. We identify the impact of land property rights by making use of a country-wide certification program in Mexico ejido sector. Specifically, we exploit both the gradual introduction of the program and households' eligibility status.

Comparing eligible and ineligible households, we find that the program increased the likelihood of having one or more members abroad by 12 percent. The result is robust to the use of alternative econometric models and dependent variables. In terms of number of migrants, our coefficient estimates explain 31 percent of the 1994-1997 increase in Mexican migrants from ejido areas and 16-18 percent of the increase from the entire Mexico.

We also find some evidence that the impact of the program occurred through the land inheritance channel, initially suggested by Galiani and Schargrodsky (2010a). The land inheritance channel implies that household members refrain from migrating because they worry about losing their land inheritance. Better land property rights attenuate this problem, thus acting as a substitute for a well-defined land inheritance rule. Consistent with our model, the impact on migration is strongest in households where the landowner has not provided a will. It is difficult to reconcile this correlation with alternative rationales.

Evidence of a relationship between land property rights and international migration is interesting also for other reasons. Notwithstanding its recent increase, the level of global migration is rather low (3% of world population). This is at odds with a high cross-country wage differential and the cost of crossing borders illegally, which for at least some countries is non-prohibitive. Our analysis suggests that weak land property rights constitute a (typically unobserved) migration cost. This finding may help reconcile the puzzle.

Although the results are specific to Mexico, whose proximity to the US makes it the country with the largest stock of emigrants in the world, it would not be surprising to find similar effects for other countries as well, although possibly limited to internal migration. In 2009 the World Bank allocated about US$1.5 billion to 46 Land Administration Projects all over the world (Deininger and Bell (2010)). Many of them have emigrant to population ratios greater than Mexico (Azerbaijan, Bosnia and Herzegovina, Kyrgyz Republic, Macedonia, Nicaragua, Tajikistan and Ukraine).[52] It would be interesting to investigate whether the studied relationship holds for these countries as well.

[52] See World Bank (2011). All countries mentioned have emigrant to population ratios above 10 percent. The Philippines, which is also implementing a Land Administration project, has a ratio just below 10 percent.

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Appendix

7 Theoretical model

7.1 Equilibrium

The decision problem for household member i can be solved by backward induction.

First, consider member i's second-period allocation choice (in case of capture of the land inheritance). Drop the time-subscripts and write off-farm labor supply in terms of in-farm labor supply: $T_{io} = \bar{T} - T_{if}$. Once we do this, the choice variable is only the amount of in-farm labor supply and we can further simplify the notation: $T_{if} = T_i$. Member i faces the following problem:

$$\max_{T_i} \left\{ Y(T_i, L) + w(\bar{T} - T_i) \right\} \text{ s.t. } \begin{cases} \bar{T} - T_i \geq 0 \\ T_i \geq 0 \end{cases}$$

The corresponding first-order conditions are:

$$\begin{cases} Y_1(T_i^*, L) - w + \lambda \leq 0 \ (= 0 \ if \ T_i^* > 0) \\ \lambda \geq 0, \text{ with } \lambda(\bar{T} - T_i^*) = 0 \end{cases}$$

where λ is the Lagrange multiplier associated with the first constrain.

The end-point restriction in assumption 1 ensures that i's in-farm labor supply is strictly positive. However, we could either have an internal solution ($T_i^* = Y_1^{-1}(w)$) or a corner solution ($T_i^* = \bar{T}$). Label i's optimal choice as $T_i^* = \hat{T}$, where $\hat{T} = \min \left[Y_1^{-1}(w), \bar{T} \right]$.

If member i does not capture the land inheritance, then he has access only to migration and so $T_i^* = 0$.

Consider i's first-period decision problem. Again, drop the time subscript and write off-farm labor supply in terms of in-farm labor supply. Member i faces the following maximization

problem:

$$\max_{T_i} \frac{1}{N} Y(T_i + \sum_{k \neq i} T_k, L) + w(\bar{T} - T_i) + \delta \left\{ p^i \left[Y\left(\hat{T}, L\right) - w\hat{T} \right] + w\bar{T} \right\}$$
$$s.t. \bar{T} - T_i \geq 0, T_i \geq 0$$

The corresponding first-order conditions are:

$$\begin{cases} \frac{1}{N} Y_1 - w + \delta \left[Y\left(\hat{T}, L\right) - w\hat{T} \right] f'(T_i^*) \left[\sum_{k \neq i} f\left(T_k\right) + f(T_E) \right] \Pi^{-2} p_1^i + \lambda \leq 0 \ (= 0 \text{ if } T_i^* > 0) \\ \lambda \geq 0, \text{ with } \lambda(\bar{T} - T_i^*) = 0 \end{cases} \tag{i}$$

where $Y_1 \equiv Y_1(T_i^* + \sum_{k \neq i} T_k, L)$, $\Pi \equiv f\left(T_i^*\right) + \sum_{k \neq i} f\left(T_k\right) + f(T_E)$, $p_1^i \equiv p_1 \left(\frac{f(T_i^*)}{\Pi}, \theta \right)$, and λ is the Lagrangean multipliers associated with the first and second constraint.

Since the structure of the decision problem is identical for all household members, their optimal choices will also be identical. This, joint to the end-point restriction we made in assumption 1, ensures that i's optimal in-farm labor supply will be strictly positive. Thus, we could either have an internal solution or a corner solution where i devotes the labor supply exclusively to the in-farm activity.

Consider the case of an internal solution. Define the argument of the maximization problem in (i) as W^i, so that the first-order condition for household member i corresponds to equation (i) without the Lagrangian multipliers, which we can recall as

$$T_i^* : W_{T_i}^i(T_i^*, T_{k \neq i}) = 0. \tag{ii}$$

This is the necessary condition for T_i^* to be optimum. The second-order condition is:

$$W_{T_i T_i}^i = \frac{1}{N} Y_{11} + \left\{ \begin{array}{c} p_{11}^i \left[f'(T_i^*) \right]^2 \left[\sum_{k \neq i} f\left(T_k\right) + f(T_E) \right]^2 \Pi^{-2} + \\ + p_1^i \left[f''(T_i) - 2 \left[f'(T_i) \right]^2 \Pi^{-1} \right] \left[\sum_{k \neq i} f\left(T_k\right) + f(T_E) \right] \end{array} \right\} a$$

where $Y_{11} \equiv Y_{11}(T_i^* + \sum_{k \neq i} T_k, L)$, $\Pi \equiv f\left(T_i^*\right) + \sum_{k \neq i} f\left(T_k\right)$, $p_{11} \equiv p_{11} \left(\frac{f(T_i^*)}{\Pi}, \theta \right)$, $p_1 \equiv$

$p_1\left(\frac{f(T_i^*)}{\Pi},\theta\right)$ and $a \equiv \delta\left[Y(\hat{T}) - w\hat{T}\right](\Pi)^{-2}$.

Since Y_{11}, p_{11} and f'' are negative, while p_1 and f' are positive, then $W^i_{T_iT_i} < 0$. So the function W^i is strictly concave and equation (ii) is a sufficient condition for T_i^* to be the maximum.

The pure-strategy Nash equilibrium is the vector of optimal in-farm labor supplies $(T_1^*, .., T_N^*)$ with generic element T_i^* such that equation (ii) is valid simultaneously for all household members. As we noticed above, in equilibrium household members' equilibrium choices will be identical: $T_1^* = T_2^* = .. = T^*$.

7.2 Comparative statics

Notice that the equilibrium condition for household member i is $W^i_{T_i}\left(T_1^*, .., T_N^*; N, L, w, \delta, s, \bar{T}, \theta\right) = 0$. Totally differentiate $W^i_{T_i}$ and assume that $dN = dL = dw = d\delta = ds = d\bar{T} = 0$, while $d\theta \neq 0$. Then the comparative static for household member i is:

$$\frac{dT_i^*}{d\theta} = \frac{\begin{vmatrix} W^1_{T_1T_1} & .. & -W^1_{T_1\theta} & .. & W^1_{T_1T_N} \\ .. & .. & .. & .. & .. \\ W^N_{T_1T_N} & .. & -W^N_{T_N\theta} & .. & W^N_{T_NT_N} \end{vmatrix}}{\begin{vmatrix} W^1_{T_1T_1} & .. & W^1_{T_1T_i} & .. & W^1_{T_1T_N} \\ .. & .. & .. & .. & .. \\ W^N_{T_1T_N} & .. & W^N_{T_NT_i} & .. & W^N_{T_NT_N} \end{vmatrix}} \qquad \text{(iii)}$$

where all elements are evaluated in correspondence of the equilibrium vector $(T_1^*, .., T_N^*)$

and the generic elements $W^i_{T_iT_i}$, $W^i_{T_iT_j}$ and $W^i_{T_i\theta}$ are:

$$\begin{aligned}
W^i_{T_iT_i} &= \frac{1}{N}Y_{11} + \left\{ \begin{array}{c} p^i_{11}\left[f'(T^*_i)\right]^2\left[\sum_{k\neq i} f\left(T^*_k\right) + f(T_E)\right]^2\left(\Pi^*\right)^{-2} + \\ +p_1\left[f''(T^*_i) - 2\left[f'(T^*_i)\right]^2\left(\Pi^*\right)^{-1}\right]\left[\sum_{k\neq i} f\left(T^*_k\right) + f(T_E)\right] \end{array} \right\} a \\
W^i_{T_iT_j} &= \frac{1}{N}Y_{11} + \left\{ \begin{array}{c} -p^i_{11}f'(T^*_i)\left[\sum_{k\neq i} f\left(T^*_k\right) + f(T_E)\right] f'\left(T^*_j\right) f(T^*_i)\left(\Pi^*\right)^{-2} + \\ +p_1\left\{1 - 2\left[\sum_{k\neq i} f\left(T^*_k\right) + f(T_E)\right]\left(\Pi^*\right)^{-1}\right\} f''(T^*_j)f'(T^*_i) \end{array} \right\} a \\
W^i_{T_i\theta} &= p_{12}f'(T^*_i)\left[\sum_{k\neq i} f\left(T^*_k\right) + f(T_E)\right] a
\end{aligned}$$

Since in equilibrium $T^*_1 = .. = T^*_N = T^*$, the previous expressions can be simplified significantly: $f\left(T^*_i\right) = f\left(T^*_j\right) = f\left(T^*\right) = f$, $\sum_{k\neq i} f\left(T^*_k\right) + f(T_E) = \Pi^* - f$, $f'\left(T^*\right) \equiv f_T$, $f''\left(T^*\right) \equiv f_{TT}$ $\forall i, j$ and $f(T_E) = f_E$. We also drop the star symbol from Π^*. The previous expressions become:

$$\begin{aligned}
W^i_{T_iT_i} &= \frac{1}{N}Y_{11} + \left\{p_{11}\left(f_T\right)^2\left(\Pi - f\right)^2\Pi^{-2} + p_1\left[f_{TT} - 2\left(f_T\right)^2\Pi^{-1}\right]\left(\Pi - f\right)\right\} a \\
W^i_{T_iT_j} &= \frac{1}{N}Y_{11} + \left\{-p_{11}\left(f_T\right)^2\left(\Pi - f\right)f\Pi^{-2} + p_1\left[1 - 2\left(\Pi - f\right)\Pi^{-1}\right]\left(f_T\right)^2\right\} a \\
W^i_{T_i\theta} &= p_{12}f_T\left(\Pi - f\right) a
\end{aligned}$$

Consider the denominator in equation (iii). Subtract column (N) from columns (1) to (N-1) and "move out" the common factor a from columns (1) to (N-1). Then add rows (1) to (N-1) to row (N).

Consider the numerator. Extract the common factor from column (i). Then subtract row (i) from all other rows and extract the common factor a from the latter.

$$= -\frac{a^N f_T(\Pi - f) p_{12}}{a^{N-1}} \frac{\begin{vmatrix} \psi & 0 & .. & 0 & .. & 0 \\ 0 & \psi & .. & 0 & .. & 0 \\ .. & .. & .. & .. & .. & .. \\ W^i_{T_iT_1} & W^i_{T_iT_2} & .. & 1 & .. & W^i_{T_iT_N} \\ .. & .. & .. & .. & .. & .. \\ 0 & 0 & .. & 0 & .. & \psi \end{vmatrix}}{\begin{vmatrix} \psi & 0 & .. & 0 & W^1_{T_1T_N} \\ 0 & \psi & .. & 0 & W^2_{T_2T_N} \\ .. & .. & .. & .. & .. \\ 0 & 0 & .. & \psi & W^{N-1}_{T_{N-1}T_N} \\ 0 & 0 & .. & 0 & \phi \end{vmatrix}}$$

$$= -\frac{a f_T(\Pi - f) p_{12}}{\phi} = -\frac{a f_T(\Pi - f) p_{12}}{Y_{11} + p_1\left[f_{TT}(\Pi - f) - (N-1)(f_T)^2 - 2(f_T)^2 f_E \Pi^{-1}\right] a}$$

where $\psi \equiv p_{11}(f_T)^2(\Pi - f)\Pi^{-1} + p_1\left[f_{TT}(\Pi - f) - (f_T)^2\right]$,

$\phi \equiv Y_{11} + p_1\left[f_{TT}(\Pi - f) - (N-1)(f_T)^2 - 2(f_T)^2 f_E \Pi^{-1}\right] a$ and $W^1_{T_1T_N} = W^2_{T_2T_N} = .. = W^{N-1}_{TN-1T_N}$.

Since p_{12}, Y_{11} and f_{TT} are negative, while f_T and p_1 are positive, then $\frac{dT_i^*}{d\theta} < 0 \; \forall i = 1, .., N$.

Since $T_{io} = \bar{T} - T_i$, then $\frac{dT_i^*}{d\theta} < 0$ implies $\frac{dT_{io}^*}{d\theta} > 0$.

Consider the case of a corner solution: all household members devote their entire household labor supply to the in-farm activity ($T^* = \bar{T}$). An increase in land property rights (θ) may not be enough to change the equilibrium choice from corner to internal, so the comparative static will be $\frac{dT_i^*}{d\theta} \leq 0$ and $\frac{dT_{io}^*}{d\theta} \geq 0$.

8 Derivation of the estimator

Re-write the baseline comparison in terms of potential outcomes:

$$\{E[M_i(1,1)|P=1,E=1] - E[M_i(1,0)|P=1,E=0]\}+$$
$$-\{E[M_i(0,1)|P=0,E=1] - E[M_i(0,0)|P=0,E=0]\}.$$

The assumption of random allocation of the program across eligible and non-eligible households lets us manipulate this expression as follows:

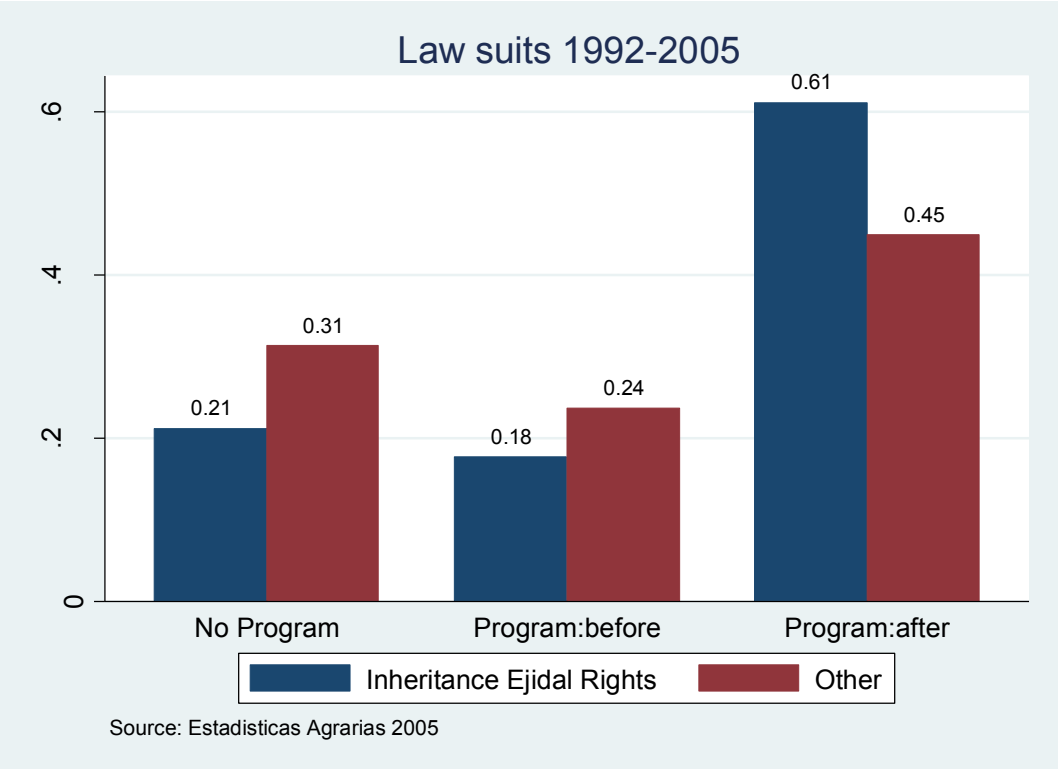
$$\{E[M_i(1,1)|P=1,E=1] - E[M_i(1,0)|P=1,E=0]\}+$$
$$-\{E[M_i(0,1)|P=1,E=1] - E[M_i(0,0)|P=1,E=0]\},$$

which clearly reduces to:

$$\{E[M_i(1,1) - M_i(0,1)|P=1,E=1] - E[M_i(1,0) - M_i(0,0)|P=1,E=0]\}.$$

Figure 1

Law cases concerning land inheritance before and after Procede



Note: the figure shows the differential increase of law suits concerning land inheritance (relative to other categories) after the program took place. See Morales Jurado and Colin Salgado (2006) for details.

Table 1

PANEL A: REASONS TO IMPLEMENT THE PROGRAM		
Sample	Program areas (N=111)	Non-program areas, in process (N=41)
	mean	mean
Tenure security	0.883	0.756
Solve border issues	0.297	0.293
Obey the law	0.153	0.146
Access credit	0.108	0.098
Rent and sell the land	0.108	0.024
Access to Procampo	0.018	0.098
Invest in the land	0.018	0.000
Other	0.000	0.024

PANEL B: REASONS NOT TO IMPLEMENT THE PROGRAM	
Sample	Non program areas, program not even started (N=69)
	mean
Lack of information	0.304
Avoid taxes	0.159
Border issues	0.159
Avoid conflicts between ejidatarios and non-ejidatarios	0.087
They did not summoned us	0.029
Lack of documents	0.043
Avoid land transactions	0.014
No interest in selling and buying land	0.000
Other	0.000

Note: Data from the 1997 community-level ejido survey. Ejidos that had terminated or started to implement Procede were asked the reasons for their decision to implement. Ejidos that had not started to implement the program were asked about the reason for this.

Table 2

DESCRIPTIVE STATISTICS, COMMUNITY-LEVEL

	1994			1997		
	Program mean (1)	No Program mean (2)	Diff (3)	Program mean (4)	No Program mean (5)	Diff (6)
Log ejido area (ha)	6.85	7.14	*	7.00	7.16	
% urban area wrt ejido area (ha)	3.53	3.41		2.80	2.28	
% parcelled land wrt agr land (ha)	70.84	58.21	***	73.02	59.80	***
Number of ejidatarios [1]	87.01	112.74	**	104.46	108.65	
Number of posesionarios[1]		N/A		9.67	24.87	**
Number of avecindados[1]	73.55	62.91		53.92	45.67	
Ratio avecindados/ejidatario households	0.85	0.67		0.64	0.50	
Average parcelled land per ejidatario (ha)	13.12	11.90		14.69	12.04	
Inequality land[2]	6.03	9.85	*	9.33	10.10	
Common land per ejidatario (ha)	9.84	8.64		9.43	10.56	
Indigenous ejido	0.16	0.11		0.31	0.25	
Membership to ejido union	0.32	0.41		0.25	0.28	
Distance from closest urban centre (km)		N/A		23.93	27.59	
Number of urban centres within a hour		N/A		1.72	1.39	*
At least one irrigation facility		N/A		0.42	0.31	*
At least one storing facility		N/A		0.15	0.19	
Access to paved road	0.35	0.22	**	0.70	0.58	*
% dwellings with electricity	79.79	71.31	*	82.32	80.05	
% dwellings with drinking water	62.21	49.06	**	68.13	54.57	**
% dwellings with drenage	15.19	13.22		14.06	9.41	
Public phone	0.55	0.49		0.61	0.53	
Street lightning	0.69	0.63		0.73	0.72	
Auditorium/assembly hall	0.61	0.44	***	0.64	0.38	***
External boundary problems[3]	0.24	0.59	***	0.12	0.47	***
Internal boundary problem[3]		N/A		0.14	0.18	
Boundary problem in communal land[3]	0.14	0.40	***	0.06	0.09	
Squatting common land[3]		N/A		0.12	0.30	***
Kindergarden[3]		N/A		0.80	0.85	
Primary school[3]	0.96	0.95		0.95	0.96	
Secondary school[3]		N/A		0.44	0.49	
At least one social program	0.57	0.46		0.54	0.54	
At least one environmental problem		N/A		0.42	0.50	
Observations	111	110		111	110	

* significant at 10%; ** significant at 5%; *** significant at 1%. Column (3) reports the significance of the difference (1)-(2). Column (6) reports the significance level of the difference (4)-(5). Definition of "Program" in the text.

[1] *Posesionarios* are households with ejido membership and formal right to land; *avecindados* are households with ejido membership but no formal right to land, although part of them own land illegally; *posesionarios* are households with no ejido membership and no formal right to land, although most of them owns land illegally.

[2] Land inequality measured as the ratio between the biggest and the smallest plot for entitled individuals.

[3] The definition of some variables differ across the two surveys: indigenous ejido (1997: "Are there people who consider themselves indigenous?"; 1994:"Does the majority belong to an ethnic group?"); external boundary problems (1997: "Are there boundary problems with other ejidos or other borderign private properties?"; 1994: "Are there law problems concerning the ejido borders?"); internal boundary problems (1997:"Are there boundary problems between ejidatarios about the division of parcelled land?"; 1994: none); boundary problems related to communal land (1997: "Are there border problems between ejidatarios about the assignment of communal land?"; 1994:"Are there problems concerning the borders of communal land?"); squatting of communal land (1997: "Is there communal land squatted by families without documentation?"; 1994: none); schools (1997:"Does the community have a kindergarden/ primary/secondary school?"; 1994:"Does the community have a school?").

Table 3

PRE-PROGRAM DESCRIPTIVE STATISTICS, HOUSEHOLD LEVEL

	1994 All	1997 All	1994 Eligible				1994 Non-Eligible				
			Program	No Program	Diff		Program	No Program	Diff		Diff-diff
	mean	mean	mean	mean	t-stat		mean	mean	t-stat		t-stat
	(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)		(9)
A: Migration variables											
At least one household member currently living at home has been abroad (last 3 years)	0.04	0.08	0.04	0.04	(0.446)		0.02	0.04	(-1.118)		(1.196)
At least one household head's child is currently abroad	0.12	0.23	0.10	0.15	(-1.439)		0.09	0.12	(-0.527)		(-0.442)
Migrant household (last 3 years)	0.15	0.29	0.14	0.17	(-0.784)		0.11	0.15	(-0.629)		(0.045)
Number of migrants abroad (last 3 years)	0.30	0.72	0.27	0.38	(-1.048)		0.20	0.31	(-0.945)		(0.013)
B: Household composition											
Household head's age	49.85	52.88	51.06	50.83	(0.156)		48.04	47.59	(0.255)		(-0.111)
Household head's sex	0.97	0.97	0.97	0.97	(-0.030)		0.95	0.99	(-1.695)	*	(1.397)
Household head's schooling	3.27	3.20	3.34	3.12	(0.784)		3.45	3.24	(0.564)		(0.047)
Average schooling of adult members	4.68	4.66	4.79	4.67	(0.409)		4.48	4.71	(-0.663)		(0.868)
Number of adult members	5.92	6.71	6.14	6.16	(-0.061)		5.31	5.67	(-0.831)		(0.638)
Share females among adult members	0.44	0.37	0.45	0.44	(0.804)		0.44	0.41	(1.432)		(-0.677)
Number of household head's siblings abroad	0.14	0.38	0.11	0.20	(-1.468)		0.09	0.12	(-0.576)		(-0.891)
C: Household assets											
1992 land assets (owned)	11.76	11.76	12.09	12.31	(-0.139)		10.61	11.29	(-0.325)		(0.205)
Hired labor	0.37	0.45	0.42	0.37	(0.950)		0.36	0.28	(1.211)		(-0.356)
Tractor	0.47	0.46	0.56	0.45	(1.750)	*	0.49	0.31	(2.092)	**	(-0.722)
Pickup	0.32	0.21	0.37	0.30	(1.340)		0.27	0.31	(-0.549)		(1.332)
Machinery	0.59	0.59	0.66	0.55	(1.931)	*	0.61	0.50	(1.419)		(0.023)
Cattle	0.47	0.45	0.44	0.54	(-1.835)	*	0.39	0.50	(-1.445)		(0.074)
Horses	0.23	0.30	0.25	0.24	(0.380)		0.23	0.20	(0.614)		(-0.266)
D: Land transactions											
At least one land rental transaction (last 2 years)	0.10	0.21	0.12	0.10	(0.877)		0.12	0.07	(1.458)		(-0.434)
At least one plot rented in (last 2 years)	0.06	0.09	0.06	0.06	(0.211)		0.08	0.05	(0.980)		(-0.671)
At least one plot rented out (last 2 years)	0.04	0.09	0.06	0.04	(0.928)		0.04	0.02	(1.093)		(0.052)
Observations	926	926	298	302			169	157			

* significant at 10%; ** significant at 5%; *** significant at 1%. Columns (1) and (2) report sample means from the 1994 and 1997 surveys respectively. Column (5) reports the t-statistic of the difference (3)-(4). Column (8) reports the t-statistic of the difference (6)-(7). Column (9) reports the t-statistic of the difference [(3)-(4)]-[(6)-(7)]. Standard errors associated with the diff-in-mean tests have been clustered at the ejdo-level. Definition of "Program," "Eligible," and household in the text. Land assets measured in National Rainfed Equivalent (NRE) hectares. For a description of the procedure, see de Janvry et al. (1997).

Table 4

HOUSEHOLD MIGRATION, CROSS-SECTION ESTIMATES

	(1)	(2)	(3)	(4)	(5)
Dependent variable:	Migrant household			Number migrants	Share migrants
Model:	LPM	LPM	Logit, marg effects	OLS	OLS
	coef/se	coef/se	coef/se	coef/se	coef/se
Program × Eligible	0.115	0.127*	0.119	0.426**	0.075***
	(0.077)	(0.065)	0.067	(0.200)	(0.025)
Program	-0.081	-0.056	-0.074	-0.239	-0.039*
	(0.066)	(0.056)	0.060	(0.183)	(0.022)
Eligible	-0.031	0.104	0.187	-0.055	0.055
	(0.058)	(0.178)	0.192	(0.589)	(0.076)
Household controls					
Land assets		0.000	0.000	0.003	-0.000
		(0.002)	0.002	(0.008)	(0.001)
Household head's age		0.004*	0.006	0.007	0.002*
		(0.003)	0.003	(0.007)	(0.001)
Average literacy adult household members		0.016	0.014	-0.466	-0.036
		(0.119)	0.101	(0.443)	(0.050)
Average schooling adult household members		0.003	0.007	0.020	0.004
		(0.010)	0.011	(0.027)	(0.003)
Share of females among adult household members		-0.197***	-0.226	-0.357*	-0.047*
		(0.060)	0.093	(0.184)	(0.026)
Household size		0.027***	0.026	0.108***	0.003
		(0.009)	0.009	(0.033)	(0.004)
Number of household head's siblings abroad		-0.033	-0.017	-0.108	-0.016
		(0.049)	0.053	(0.143)	(0.016)
Ejido controls					
Log ejido area (ha)		-0.015	-0.014	-0.075	-0.005
		(0.023)	0.024	(0.088)	(0.010)
% common land relative to agricultural land (ha)		-0.001	-0.001	-0.000	-0.000
		(0.001)	0.001	(0.002)	(0.000)
Number of ejidatarios		-0.000	0.000	0.000	0.000
		(0.000)	0.000	(0.001)	(0.000)
Indigenous ejido		-0.159***	-0.188	-0.356***	-0.053***
		(0.041)	0.048	(0.117)	(0.014)
Membership to ejido union		0.022	0.013	0.117	0.006
		(0.045)	0.045	(0.154)	(0.016)
Access to paved road		-0.097**	-0.103	-0.211	-0.036**
		(0.047)	0.045	(0.150)	(0.017)
Constant	yes	yes	yes	yes	yes
Household controls*Eligible		yes	yes	yes	yes
Observations	926	898	898	898	898
Number of ejidos	221	213	213	213	213
Adjusted R-squared	0.001	0.157	0.169	0.174	0.094

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors (in brackets) clustered at the ejido level. Econometric methodology: Linear Probability Model (LPM) or OLS (Column 1-2, 4-5), Logit (Column 3). The marginal effect associated with the interaction term in Column 4 was computed following Norton, Wang and Ai (2004). Definitions of "Migrant household," "Program," "Eligible," and household in the text. Literacy is computed for members currently living at home only.

Table 5

BASELINE ESTIMATES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable:	Migrant household					Number migrants	Share migrants	Migrant household	Number migrants	Share migrants
Model:	LPM	LPM	LPM	LPM	Logit, marg effects	OLS	OLS	LPM	OLS	OLS
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
PANEL A: HOUSEHOLD MIGRATION, RESTRICTED SAMPLE										
Program × 1997	-0.035	-0.060	-0.062	-0.054	-0.039	-0.175	-0.032			
	(0.062)	(0.060)	(0.069)	(0.062)	0.065	(0.191)	(0.021)			
Timing × 1997								-0.026	-0.071	-0.015
								(0.044)	(0.136)	(0.014)
Observations	452	451	451	451	451	451	451	432	432	432
Number of ejidos	98	98	98	98	98	98	98	93	93	93
Adjusted R-squared	0.042	0.126	0.495	0.156	0.152	0.159	0.141	0.158	0.165	0.148
PANEL B: HOUSEHOLD MIGRATION, PANEL ESTIMATES										
Program × Eligible × 1997	0.112*	0.124**	0.123*	0.121**	0.129	0.348**	0.070***			
	(0.061)	(0.062)	(0.065)	(0.062)	0.056	(0.167)	(0.021)			
Program × 1997	-0.047	-0.053	-0.053	-0.054	0.030	-0.180	-0.037**			
	(0.053)	(0.052)	(0.055)	(0.053)	0.035	(0.143)	(0.018)			
Timing × Eligible × 1997								0.087**	0.242**	0.047***
								(0.041)	(0.103)	(0.014)
Timing × 1997								-0.042	-0.129	-0.025**
								(0.034)	(0.084)	(0.011)
Eligible × 1997	-0.056	-0.055	-0.051	-0.042	0.060	-0.183	-0.042**	-0.042	-0.198*	-0.043**
	(0.043)	(0.042)	(0.044)	(0.041)	0.070	(0.114)	(0.018)	(0.040)	(0.108)	(0.017)
1997	0.166***	0.138***	0.141***	0.135***	0.117	0.466***	0.070***	0.136***	0.477***	0.070***
	(0.041)	(0.040)	(0.041)	(0.038)	0.017	(0.113)	(0.017)	(0.036)	(0.106)	(0.016)
Observations	1 852	1 849	1 849	1 849	1 849	1 849	1 849	1 744	1 744	1 744
	221	221	221	221	221	221	221	209	209	209
Adjusted R-squared	0.030	0.130	0.394	0.113	0.141	0.132	0.093	0.112	0.134	0.094
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Household controls		yes	yes	yes	yes	yes	yes	yes	yes	yes
Fixed effects			ejido	household		household	household	household	household	household

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors (in brackets) clustered at the ejido level. Econometric model: Linear Probability Model (LPM) or OLS (Column 1-4, 6-10), Logit (Column 5). Details of the various specifications at the bottom of the table are valid for both panels. Marginal effects in Column 5 have been computed following Cornelissen and Sonderhof (2009). Definitions of "Migration household", "Program", "Timing", "Eligible," and household in the text. See Table 4 for the list of household controls.

Table 6

ROBUSTNESS TEST: ANTICIPATORY RESPONSE TO THE PROGRAM

PANEL A: CROSS-SECTION 1994

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent variable:	Migrant household			Number migrants	Share migrants	Migrant household		Number migrants	Share migrants
Model:	LPM	LPM	Logit, marg effects	OLS	OLS	LPM	LPM	OLS	OLS
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Program × Eligible	0.003	-0.009	0.003	-0.000	-0.001				
	(0.063)	(0.058)	0.068	(0.128)	(0.017)				
Soon-To-Be-Certified × Eligible						0.019	0.012	0.018	0.024
						(0.088)	(0.086)	(0.145)	(0.024)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes
Household controls		yes	yes	yes	yes		yes	yes	yes
Ejido-controls		yes	yes	yes	yes		yes	yes	yes
Observations	926	872	872	872	872	866	813	813	813
Number of ejidos	221	210	210	210	210	208	196	196	196
Adjusted R-squared	0.000	0.077	0.142	0.087	0.039	-0.002	0.083	0.084	0.051

PANEL B: PANEL SAMPLE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Migrant household				Number migrants	Share migrants	Migrant household	Number migrants	Share migrants
	LPM	LPM	LPM	Logit, marg	LPM	LPM	LPM	LPM	LPM
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Program × Eligible × 1997	0.097	0.113*	0.111*	0.119	0.308	0.073***			
	(0.064)	(0.066)	(0.065)	0.060	(0.188)	(0.024)			
Timing × Eligible × 1997							0.084**	0.228**	0.048***
							(0.043)	(0.112)	(0.015)
In-Process × Eligible × 1997	-0.045	-0.036	-0.033	-0.024	-0.125	0.005	-0.021	-0.083	0.006
	(0.094)	(0.090)	(0.089)	0.072	(0.234)	(0.034)	(0.088)	(0.228)	(0.033)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes
Household controls		yes	yes	yes	yes	yes	yes	yes	yes
Fixed effects			household		household	household	household	household	household
Observations	1 852	1 849	1 849	1 849	1 849	1 849	1 744	1 744	1 744
Number of ejidos	221	221	221	221	221	221	209	209	209
Adjusted R-squared	0.030	0.130	0.113	0.143	0.133	0.093	0.112	0.134	0.094

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors (in brackets) clustered at the ejido level. Marginal effect associated to Logit in Panel A computed following Norton, Wang, and Ai (2004); while in Panel B we followed Cornelissen and Sonderhof (2009). The definitions of "Migrant household," "Program," "Timing," "Eligible," and household are in the text. All estimates in Panel A include: Program (or Timing, in Columns 7-9), Soon-to-be-certified, Eligible. All estimates in Panel B include: Program*1997 (or Timing*1997, in Columns 7-9), In-process*1997, Eligible*1997, 1997. See Table 4 for the list of household and ejido controls.

Table 7

HOUSEHOLD MIGRATION, IMPACT BY INHERITANCE STATUS

	(1)	(2)	(3)
Dependent variable:	Migrant household		
Model:	LPM		
Sample:	All	Will	No Will
	coef/t	coef/t	coef/t
Program × Eligible × 1997	0.121**	0.039	0.147**
	(0.062)	(0.103)	(0.070)
Program × 1997	-0.054	-0.034	-0.041
	(0.053)	(0.077)	(0.060)
Eligible × 1997	-0.042	0.022	-0.051
	(0.041)	(0.066)	(0.049)
1997	0.135***	0.120**	0.122***
	(0.038)	(0.052)	(0.045)
Constant	yes	yes	yes
Household controls	yes	yes	yes
Fixed effects	household	household	household
Observations	1 849	661	1 178
Number of ejidos	221	149	195
Adjusted R-squared	0.113	0.087	0.132

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors (in brackets) clustered at the ejido level. Sample: all households (Column 1); households with a will (Column 2); households without a will (Column 3). Econometric methodology: Linear Probability Model (LPM). Definitions of "Migrant household," "Program," "Eligible," and household in the text. See Table 4 for the list of household controls.

Table A1

AFTER-PROGRAM DESCRIPTIVE STATISTICS, HOUSEHOLD-LEVEL

	All	Eligible			Non-Eligible			
		Program	No Program	Diff	Program	No Program	Diff	Diff-diff
	mean	mean	mean	t-stat	mean	mean	t-stat	t-stat
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A: Migration variables								
At least one household member currently living at home has been abroad (last 3 years)	0.08	0.11	0.07	(1.513)	0.07	0.07	(0.031)	(1.044)
At least one household head's child is currently abroad	0.23	0.23	0.25	(-0.212)	0.18	0.27	(-1.479)	(1.178)
Migrant household (last 3 years)	0.29	0.32	0.28	(0.610)	0.23	0.31	(-1.224)	(1.498)
Number of migrants abroad (last 3 years)	0.72	0.77	0.72	(0.272)	0.52	0.83	(-1.511)	(1.538)
B: Household composition								
Household head's age	52.88	53.71	53.89	(-0.136)	51.23	51.15	(0.048)	(-0.128)
Household head's sex	0.97	0.96	0.97	(-0.740)	0.96	0.99	(-1.484)	(0.754)
Household head's schooling	3.20	3.33	3.06	(0.935)	3.47	2.92	(1.507)	(-0.675)
Average schooling of adult members	4.66	4.67	4.68	(-0.067)	4.78	4.48	(0.910)	(-0.881)
Number of adult members	6.71	6.65	6.99	(-1.010)	6.40	6.62	(-0.509)	(-0.221)
Share females among adult members	0.37	0.38	0.38	(0.099)	0.38	0.37	(0.431)	(-0.300)
Number of household head's siblings abroad	0.38	0.38	0.38	(-0.016)	0.28	0.47	(-1.225)	(1.121)
C: Household assets								
1992 land assets (owned)	11.76	12.09	12.31	(-0.139)	10.61	11.29	(-0.325)	(0.205)
Hired labor	0.45	0.44	0.49	(-0.984)	0.43	0.41	(0.270)	(-0.843)
Tractor	0.46	0.56	0.41	(2.511) **	0.47	0.37	(1.141)	(0.621)
Pickup	0.21	0.24	0.17	(1.767) *	0.19	0.25	(-0.878)	(1.724) *
Machinery	0.59	0.69	0.53	(2.647) ***	0.60	0.50	(1.199)	(0.642)
Cattle	0.45	0.40	0.53	(-2.430) **	0.36	0.52	(-2.212) **	(0.417)
Horses	0.30	0.28	0.34	(-1.364)	0.21	0.34	(-2.121) **	(0.921)
D: Land transactions								
At least one land rental transaction (1994-1997)	0.21	0.28	0.19	(2.081) **	0.17	0.17	(-0.008)	(1.407)
At least one plot rented in (1994-1997)	0.09	0.11	0.08	(1.227)	0.07	0.10	(-1.044)	(1.559)
At least one plot rented out (1994-1997)	0.09	0.14	0.08	(1.813) *	0.08	0.03	(1.610)	(0.396)
Observations	926	298	302		169	157		

* significant at 10%; ** significant at 5%; *** significant at 1%. Column (1) reports sample means from the 1997 household survey. Columns (4) reports the t-statistics of the difference (2)-(3). Column (7) reports the t-statistic of the difference (5)-(6). Column (8) reports the t-statistic of the difference [(2)-(3)]-[(5)-(6)]. Standard error associated with the diff-in-mean tests have been clustered at the ejido-level. Definitions of "Migrant household," "Program," "Eligible," and household in the text. All migration indicators (but the number of migrants) are binary variables. Land assets measured in National Rainfed Equivalent (NRE) hectares. For a description of the procedure, see de Janvry et al. (1997). The number of adult members is computed relative to the biological household, i.e., household members currently living at home and children of the household head living outside home.

Table A2

PRE-PROGRAM DESCRIPTIVE STATISTICS, EARLY VS LATE PROGRAM AREAS

	All	Eligible				Non-Eligible				
		Early	Late	Diff		Early	Late	Diff		Diff-diff
	mean	mean	mean	t-stat		mean	mean	t-stat		t-stat
	(1)	(2)	(3)	(4)		(5)	(6)	(7)		(8)
A: Migration variables										
At least one household member currently living at home has been abroad (last 3 years)	0.04	0.07	0.02	(2.250)	**	0.03	0.01	(0.707)		(1.193)
At least one household head's child is currently abroad	0.09	0.07	0.09	(-0.534)		0.11	0.08	(0.393)		(-0.648)
Migrant household (last 3 years)	0.12	0.14	0.11	(0.542)		0.14	0.10	(0.591)		(-0.169)
Number of migrants abroad (last 3 years)	0.23	0.28	0.21	(0.637)		0.19	0.21	(-0.131)		(0.508)
B: Household composition										
Household head's age	49.36	49.85	51.13	(-0.520)		47.69	47.49	(0.075)		(-0.415)
Household head's sex	0.96	0.97	0.96	(0.606)		0.9	0.99	(-2.097)	**	(2.195) **
Household head's schooling	3.49	3.11	3.91	(-1.868)	*	3.45	3.59	(-0.255)		(-1.049)
Average schooling of adult members	4.71	4.72	4.91	(-0.447)		4.26	4.80	(-1.159)		(0.611)
Number of adult members	3.30	3.27	3.26	(0.040)		2.90	3.74	(-2.256)	**	(1.948) *
Share females among adult members	0.45	0.44	0.47	(-0.949)		0.47	0.43	(1.118)		(-1.568)
Number of household head's siblings abroad	0.10	0.15	0.04	(1.845)	*	0.14	0.07	(0.963)		(0.561)
C: Household assets										
1992 land assets (owned)	11.86	11.32	13.66	(-0.973)		8.56	13.18	(-1.848)	*	(0.877)
Access to electricity	0.69	0.64	0.75	(-0.991)		0.66	0.71	(-0.451)		(-0.386)
Tractor	0.53	0.59	0.47	(1.191)		0.56	0.46	(0.721)		(0.182)
Pickup	0.34	0.36	0.40	(-0.426)		0.31	0.26	(0.481)		(-0.723)
Machinery	0.64	0.68	0.62	(0.667)		0.67	0.60	(0.642)		(-0.069)
Cattle	0.43	0.40	0.50	(-1.118)		0.38	0.42	(-0.439)		(-0.540)
Horses	0.25	0.25	0.28	(-0.549)		0.32	0.14	(2.558)	**	(-2.477) **
Observations	414	142	116			72	84			

* significant at 10%; ** significant at 5%; *** significant at 1%. Column (1) reports sample means from the 1994 household survey. Columns (4) reports the t-statistics of the difference (2)-(3). Column (7) reports the t-statistic of the difference (5)-(6). Column (8) reports the t-statistic of the difference [(2)-(3)]-[(5)-(6)]. Standard errors associated with the diff-in-mean tests have been clustered at the ejido level. Definitions of "Migrant household," "Early," "Late," "Eligible,"and household in the text. Land assets measured in National Rainfed Equivalent (NRE) hectares. For a description of the procedure, see de Janvry et al. (1997).

Table A3

PANEL ESTIMATES, ADDITIONAL CONTROLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable:	Migrant household					Number migrants	Share migrants	Migrant household	Number migrants	Share migrants
Model:	LPM	LPM	LPM	LPM	Logit, marg effects	OLS	OLS	LPM	OLS	OLS
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Program × Eligible × 1997	0.112*	0.116*	0.118*	0.117*	0.126	0.352**	0.069***			
	(0.061)	(0.061)	(0.064)	(0.061)	0.054	(0.164)	(0.021)			
Program × 1997	-0.047	-0.040	-0.043	-0.044	0.034	-0.159	-0.033*			
	(0.053)	(0.053)	(0.056)	(0.054)	0.036	(0.140)	(0.018)			
Timing × Eligible × 1997								0.085**	0.249**	0.046***
								(0.041)	(0.104)	(0.014)
Timing × 1997								-0.036	-0.124	-0.023**
								(0.035)	(0.086)	(0.011)
Eligible × 1997	-0.056	-0.060	-0.061	-0.053	0.074	-0.239**	-0.046***	-0.052	-0.252**	-0.046***
	(0.043)	(0.042)	(0.044)	(0.041)	0.072	(0.113)	(0.017)	(0.038)	(0.107)	(0.016)
1997	0.166***	0.137***	0.144***	0.140***	0.120	0.490***	0.071***	0.141***	0.506***	0.071***
	(0.041)	(0.041)	(0.042)	(0.039)	0.018	(0.112)	(0.017)	(0.037)	(0.105)	(0.016)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Household controls		yes	yes	yes	yes	yes	yes	yes	yes	yes
Household assets		yes	yes	yes	yes	yes	yes	yes	yes	yes
Fixed effects			ejido	household		household	household	household	household	household
Observations	1 852	1 849	1 849	1 849	1 849	1 849	1 849	1 744	1 744	1 744
Number of ejidos	221	221	221	221	221	221	221	209	209	209
Adjusted R-squared	0.030	0.161	0.399	0.131	0.179	0.162	0.111	0.134	0.166	0.114

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors (in brackets) clustered at the ejido level. Econometric model: Linear Probability Model (LPM) or OLS (Column 1-4, 6-10), Logit (column 5). Marginal effects in Column 6 have been computed following Cornelissen and Sonderhof (2009). Definitions of "Migrant household," "Program," "Timing," "Eligible," and household in the text. See Table 4 for the list of household controls. Household assets are the binary indicators for: use tractor; use machinery; ownership cattle; ownership work animal. All additional controls are included in levels (using their pre-program value) and interacted with the 1997 time indicator.

Table A4

HOUSEHOLD MIGRATION, PANEL ESTIMATES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable:	Migrant household					Number migrants	Share migrants	Migrant household	Number migrants	Share migrants
Model:	LPM	LPM	LPM	LPM	Logit, marg effects	OLS	OLS	LPM	OLS	OLS
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
PANEL A: ELIGIBLE HOUSEHOLDS										
Program × 1997	0.065	0.077*	0.074*	0.074*	0.079	0.200*	0.037**			
	(0.041)	(0.041)	(0.044)	(0.040)	0.042	(0.118)	(0.015)			
Timing × 1997								0.050**	0.128*	0.023**
								(0.024)	(0.069)	(0.009)
1997	0.109***	0.075***	0.083***	0.085***	0.085	0.246***	0.025***	0.088***	0.251***	0.026***
	(0.026)	(0.025)	(0.027)	(0.025)	0.026	(0.064)	(0.008)	(0.023)	(0.061)	(0.008)
Observations	1 200	1 198	1 198	1 198	1 198	1 198	1 198	1 118	1 118	1 118
Number of ejidos	187	187	187	187	187	187	187	176	176	176
Adjusted R-squared	0.028	0.163	0.389	0.121	0.177	0.149	0.102	0.117	0.145	0.096
PANEL B: NON-ELIGIBLE HOUSEHOLDS										
Program × 1997	-0.047	-0.050	-0.050	-0.049	-0.044	-0.180	-0.035*			
	(0.053)	(0.056)	(0.064)	(0.057)	0.061	(0.151)	(0.018)			
Timing × 1997								-0.038	-0.135	-0.023**
								(0.036)	(0.092)	(0.012)
1997	0.166***	0.141***	0.146***	0.143***	0.123	0.509***	0.071***	0.146***	0.528***	0.072***
	(0.041)	(0.043)	(0.047)	(0.042)	0.038	(0.123)	(0.017)	(0.039)	(0.114)	(0.016)
Observations	652	651	651	651	651	651	651	626	626	626
Number of ejidos	141	141	141	141	141	141	141	135	135	135
Adjusted R-squared	0.033	0.160	0.441	0.189	0.197	0.223	0.197	0.195	0.232	0.207
PANEL C: ALL HOUSEHOLDS										
Program × 1997	0.026	0.037	0.035	0.034	0.042	0.064	0.011			
	(0.035)	(0.036)	(0.038)	(0.035)	0.036	(0.098)	(0.012)			
Timing × 1997								0.022	0.039	0.007
								(0.021)	(0.057)	(0.008)
1997	0.129***	0.096***	0.103***	0.106***	0.098	0.336***	0.041***	0.107***	0.342***	0.041***
	(0.025)	(0.024)	(0.025)	(0.024)	0.024	(0.064)	(0.009)	(0.023)	(0.062)	(0.008)
Observations	1 852	1 849	1 849	1 849	1 849	1 849	1 849	1 744	1 744	1 744
Number of ejidos	221	221	221	221	221	221	221	209	209	209
Adjusted R-squared	0.029	0.160	0.396	0.128	0.171	0.158	0.103	0.127	0.159	0.103
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Household controls		yes	yes	yes	yes	yes	yes	yes	yes	yes
Fixed effects			ejido	household		household	household	household	household	household

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors (in brackets) clustered at the ejido level. Details of the various specifications at the bottom of the table are valid for both panels. Definitions of "Migrant household," "Program," "Timing," "Eligible," and household in the text. See Table 4 for the list of household controls.

Table A5

EXCLUDE EJIDOS WHICH IMPLEMENTED OR FAILED TO IMPLEMENT THE PROGRAM BECAUSE OF BORDER ISSUES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable:	Migrant household					Number migrants	Share migrants	Migrant household	Number migrants	Share migrants
Model:	LPM	LPM	LPM	LPM	Logit, marg effects	OLS	OLS	LPM	OLS	OLS
	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t	coef/t
Program × Eligible × 1997	0.134*	0.155*	0.151*	0.141*	0.153	0.489**	0.092***			
	(0.080)	(0.079)	(0.085)	(0.080)	0.073	(0.209)	(0.027)			
Program × 1997	-0.052	-0.062	-0.060	-0.054	0.035	-0.219	-0.044**			
	(0.068)	(0.066)	(0.070)	(0.068)	0.046	(0.168)	(0.022)			
Timing × 1997 × Eligible								0.096*	0.293**	0.059***
								(0.052)	(0.131)	(0.018)
Timing × 1997								-0.036	-0.134	-0.028**
								(0.043)	(0.105)	(0.014)
Eligible × 1997	-0.043	-0.040	-0.034	-0.015	0.096	-0.224	-0.049**	-0.018	-0.223	-0.050**
	(0.053)	(0.052)	(0.054)	(0.051)	0.086	(0.144)	(0.023)	(0.050)	(0.141)	(0.022)
1997	0.172***	0.138***	0.139***	0.129***	0.133	0.516***	0.078***	0.132***	0.520***	0.080***
	(0.050)	(0.049)	(0.050)	(0.046)	0.023	(0.139)	(0.022)	(0.044)	(0.133)	(0.021)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Household controls		yes	yes	yes	yes	yes	yes	yes	yes	yes
Fixed effects			ejido	household		household	household	household	household	household
Observations	1 328	1 326	1 326	1 326	1 326	1 326	1 326	1 245	1 245	1 245
Number of ejidos	159	159	159	159	159	159	159	150	150	150
Adjusted R-squared	0.035	0.146	0.402	0.134	0.158	0.151	0.112	0.133	0.152	0.114

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors (in brackets) clustered at the ejido level. Econometric model: Linear Probability Model (LPM) or OLS (Column 1-4, 6-10), Logit (column 5). Sample: exclude ejidos which report having implemented the program because of border issues (46 ejidos) or having failed to implement the program because of border issues and/or disputes between eligible and non-eligible households (16 ejidos). Definitions of "Migrant household," "Program," "Timing," "Eligible," and household in the text. See Table 4 for the list of household controls.

Table A6

PANEL ESTIMATES, NON-AGRICULTURAL LABOR (MEMBERS CURRENTLY AT HOME)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable:	Non-agricultural status					Number laborers	Share laborers	Non-agricultural status	Number laborers	Share laborers
Model:	LPM	LPM	LPM	LPM	Logit, marg effects	OLS	OLS	LPM	OLS	OLS
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
Program × Eligible 1997	-0.073	-0.035	-0.035	-0.018	-0.011	-0.002	-0.010			
	(0.069)	(0.066)	(0.070)	(0.066)	0.064	(0.141)	(0.026)			
Program × 1997	0.090*	0.063	0.064	0.042	0.039	0.063	0.017			
	(0.055)	(0.051)	(0.055)	(0.051)	0.032	(0.120)	(0.021)			
Timing × Eligible × 1997								-0.006	-0.025	-0.006
								(0.037)	(0.078)	(0.016)
Timing × 1997								0.006	0.032	0.005
								(0.029)	(0.067)	(0.013)
Eligible × 1997	0.075	0.065	0.059	0.078*	0.063	0.105	0.024	0.079*	0.143*	0.027
	(0.048)	(0.045)	(0.049)	(0.046)	0.034	(0.085)	(0.018)	(0.045)	(0.087)	(0.017)
1997	-0.019	-0.026	-0.020	-0.031	0.038	-0.078	-0.008	-0.031	-0.103	-0.010
	(0.038)	(0.035)	(0.038)	(0.034)	0.016	(0.066)	(0.014)	(0.033)	(0.066)	(0.013)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Household controls		yes	yes	yes	yes	yes	yes	yes	yes	yes
Fixed effects			ejido	household		household	household	household	household	household
Observations	1 852	1 849	1 849	1 849	1 849	1 849	1 849	1 744	1 744	1 744
Number of ejidos	221	221	221	221	221	221	221	209	209	209
Adjusted R-squared	0.006	0.114	0.187	0.080	0.135	0.070	0.065	0.090	0.075	0.070

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors (in brackets) clustered at the ejido level. Econometric model: Linear Probability Model (LPM) or OLS (Column 1-4, 6-10), Logit (column 5). Definition non-agricultural status: binary indicator taking value 1 if at least one member reports working outside agriculture as primary occupation. Definitions of "Program," "Timing," "Eligible," and household in the text. See Table 4 for the list of household controls.

Table A7

PANEL ESTIMATES, OTHER OUTCOMES

Model:	(1) LPM	(2) LPM	(3) LPM	(4) LPM	(5) Logit, marg effects	(6) LPM
	coef/se	coef/se	coef/se	coef/se	coef/se	coef/se
PANEL A: LAND TRANSACTIONS (RENTALS)						
Program × Eligible × 1997	0.037	0.036	0.036	0.042	0.077	
	(0.043)	(0.044)	(0.047)	(0.044)	0.086	
Program × 1997	-0.027	-0.027	-0.026	-0.031	-0.004	
	(0.035)	(0.036)	(0.039)	(0.036)	0.020	
Timing × Eligible × 1997						0.019
						(0.028)
Timing × 1997						-0.005
						(0.024)
Eligible × 1997	-0.025	-0.024	-0.026	-0.036	-0.073	-0.027
	(0.032)	(0.034)	(0.036)	(0.032)	0.056	(0.031)
1997	0.045	0.047	0.048	0.053*	0.030	0.042
	(0.028)	(0.030)	(0.032)	(0.029)	0.011	(0.028)
Observations	1 848	1 845	1 845	1 845	1 845	1 740
Number of ejidos	221	221	221	221	221	209
Adjusted R-squared	0.001	0.002	0.154	0.008	0.022	0.009
PANEL B: WAGE (NON-FAMILY) LABOR						
Program × Eligible × 1997	-0.042	-0.018	-0.034	-0.055	-0.014	
	(0.097)	(0.098)	(0.105)	(0.100)	0.102	
Program × 1997	-0.063	-0.083	-0.070	-0.054	-0.098	
	(0.085)	(0.085)	(0.092)	(0.088)	0.048	
Timing × Eligible × 1997						-0.003
						(0.060)
Timing × 1997						-0.074
						(0.049)
Eligible × 1997	-0.011	-0.018	-0.014	-0.009	-0.033	-0.029
	(0.078)	(0.078)	(0.084)	(0.081)	0.053	(0.077)
1997	0.134*	0.144**	0.140*	0.129*	0.088	0.155**
	(0.070)	(0.070)	(0.076)	(0.074)	0.025	(0.070)
Observations	1 851	1 848	1 848	1 848	1 848	1 743
Number of ejidos	221	221	221	221	221	209
Adjusted R-squared	0.010	0.033	0.221	0.024	0.033	0.030
Constant	yes	yes	yes	yes	yes	yes
Household controls		yes	yes	yes	yes	yes
Fixed effects			ejido	household		household

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors (in brackets) clustered at the ejido level. Econometric model: Linear Probability Model (LPM) or OLS (Column 1-4, 6), Logit (Column 5). Dependent variable: land transactions status (Panel A), wage (non-family) labor status (Panel B). Definition land transactions status: binary indicator taking value 1 if the household rented out or rented in land within the previous 3 years. Definition wage (non-family) labor status: binary indicator taking value 1 if the household hired any non-family member within the previous 24 months. Details of the various specifications at the bottom of the table are valid for both panels. Definitions of "Program," "Timing," "Eligible," and household in the text. See Table 4 for the list of household controls.