

**Mexico's *ejido* reforms:
Their impact on the functioning of factor markets
and land access**

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Mexico's *ejido* reforms:

Their impact on factor market participation and land access

Abstract: The constitutional reforms undertaken in Mexico in 1992, as well as the systematic implementation of a program of land rights regularization (Procede), aimed to improve the security and transferability of property rights in order to create the pre-conditions for better functioning of factor markets in rural areas. The paper examines the extent to which this has materialized by exploring systematic differences over time between certified and non-certified *ejidos* as well as the private sector. We find that land rental markets function better in *ejidos* that underwent Procede, where there was also a marked increase in households' use of common pasture land. At the same time, neither the reforms nor Procede appear to have had much impact on land sales markets and *ejidatarios'* credit access. Implications for policy and program design are discussed.

1. Introduction

Systems of communal or customary land tenure account for a large share of the world's land resources, constituting the predominant tenure form in countries such as China, Vietnam, most parts of Africa, and many Latin American countries. With population growth and increasing land scarcity, legal and administrative mechanisms to facilitate gradual evolution of these systems towards higher levels of tenure security, transferability, and possibly individualization of land rights have become a policy issue many of the countries affected. The question of individualization has also arisen in the context of the transition from collective to individual land ownership in Eastern Europe and the Former Soviet Union where it is an issue. However, little knowledge is currently available on models that could be useful in making the step from communal to more individualized forms of tenure and there is little empirical evidence on their impact.

Given the relevance of the topic, the size and the speed with which Mexico's *ejido* reforms were implemented renders this experience of particular interest. *Ejidos* account for more than 54% of Mexico's land area and, with about 3 million households, for more than half of its rural population. They were created in the context of land reforms following the 1917 revolution in the course of which individual members (*ejidatarios*) received usufruct rights to communal land, subject to a number of restrictions, e.g. the need to engage in self-cultivation and the prohibition of land rentals except in case of incapacity. While these restrictions were well-intentioned, they were widely seen as having prevented the emergence of factor markets, undermined investment incentives, and politicized land access, thus making the *ejido* sector a refuge of poverty, backwardness, and lack of capital rather than a dynamic protagonist of change (e.g. Zepeda 2000).

To counteract such stagnation, and to provide the basis for a more dynamic rural sector, the government reformed, in 1992, Article 27 of the constitution. In addition to allowing land rental, this established a

process by which ejidos could to make the transition to private property rights. New institutions, in particular an independent system of agrarian courts and the *Procuraduría Agraria* (PA) to provide legal assistance to *ejidatarios*, and a registry to facilitate independent verification of property rights, were established. A voluntary nation-wide program (PROCEDE) was initiated in 1993 to implement these changes in a participatory and systematic fashion *ejido* by *ejido*.

This program's quantitative accomplishments alone numbers are impressive: Since its inception, it has covered 20,030 *ejidos* or more than 70% of the total, regularizing an area of 45 million hectares and giving legally recognized land rights to more than 3.5 million *ejidatarios*. This provides the basis for examining the extent to which the program has attained its original aim of improving the functioning of land markets and access to credit. Well-functioning factor markets, together with increased rural investment, would be important not only to maintain agricultural productivity in the face of an aging rural population, but also in view of the need for increased international competitiveness with the introduction of NAFTA. Moreover, two thirds of the 700,000 hectares expected to be required for urban expansion during the next decades are currently owned by *ejidos* and land markets could do much to facilitate a coordinated and effective incorporation of these lands into the urban development process. On the other hand, the reforms were accompanied by widespread fears that the change in the land tenure structure would lead to a wave of land sales and the disappearance of the social sector. Examining these issues is thus of great interest for Mexico as well as for other countries.

The paper is structured as follows. Section two discusses the main contents of the legal reforms, provides a description of the sample, and the data to be used and some descriptive statistics to illustrate the productive performance of *ejido* vs. private sector as well as *ejido* members' subjective assessment of the reforms. Section three develops the main hypotheses underlying the investigation, relates them to the existing literature, and describes the econometric approach to testing them. Section four discusses the results from the econometric analysis for each of the hypotheses, in addition to descriptive statistics. Section five concludes with a number of potential policy implications.

2. Background and data sources

The changes sought by the 1992 reforms, often referred to as Mexico's "second agrarian reform" (de Janvry *et al.*, 1997) can only be understood against the background of shortcomings coming from earlier land reform efforts. Furthermore, the way in which these changes were implemented is crucial to assessing their impact. Thus, before describing the data underlying our empirical assessment, we briefly highlight the deficiencies that were to be addressed by the 1992, reforms, their main content, and the modality of their implementation.

2.1 Shortcomings of Mexico's "first agrarian reform"

From the 1917 revolution until 1992, Mexico has implemented a large scale, though slow, process of land reform. Through this process, more than 100 million hectares, or 50% of the arable area, were distributed from large farms to the so-called "social sector", households who were organized in *ejidos*, rural communities modeled after pre-colonial indigenous social structures. However, a continuing mandate for land redistribution undermined the security of property rights, legal provisions that made usufruct of *ejido* lands conditional on self-cultivation, limited rental markets, and centralized intervention by the state in day-to-day governance of the *ejido* decreased local governance and responsibility. As a consequence, *ejidos* became synonymous with clientelism, backwardness, and poverty, up to a point where living in an *ejido* was estimated to increase the probability of a household being in extreme poverty by 50% (Velez 1995). There were three main shortcomings associated with this system:

First, the limitations on functioning of land markets led to a situation whereby many *ejidatarios* were unable to make efficient use of their land while young households next to the *ejido* suffered from significant land shortages. Although no information is available for the pre-1992 period, data from 1997 indicate that the mean age in *ejidos* was 52 years, with 53% of the population being older than 50 and about 25% older than 65, many of them women. This contrasts sharply with the age distribution in rural areas overall where about 50% of the rural population are younger than 20, many of which do not have access to land. Second, restrictions on land transfers in and from the *ejido* sector posed an obstacle to the process of urban expansion. Out of a total of 150 million hectares used for urban development between 1995 and 2000, more than two thirds (105 million hectares) were from the social sector. The fact that local governments could get access to this land only via expropriation (with land values set at the agricultural rate) provided perverse incentives to *ejidatarios* to pre-empt such developments, contributing to uncontrolled expansion of informal settlements with all the associated problems (SRA, 2000). Finally, as a consequence of the legal and administrative restrictions, *ejidos* were characterized by disproportionately low levels of investment, often unsustainable resource use, and high levels of poverty. A survey of *ejidatarios* and private producers in 2000 found that the average capital endowment in *ejidos* is significantly lower than what is owned by neighboring private producers (PA 2000). All of this implied an urgent need to "complete" Mexico's land reform, a step that was the goal of the constitutional reforms of 1992.

2.2 Legal and institutional changes introduced in 1992

In 1992, a set of constitutional reforms, followed by a comprehensive package of legal and administrative changes, was undertaken to overcome these shortcomings and provide the basis for the emergence of a

more dynamic social sector. Three main elements of the legal changes were to (i) strengthen self-governance of the *ejido* in a way that allowed it to choose, among others, its property rights regime; (ii) the elimination of land rental restrictions; and (iii) a reduction of the discretionary powers of the executive.

A first issue was an increase in the status of the *ejido*. The new law explicitly recognized the legal personality of *ejidos* and allowed them, through their representatives, to enter into contracts and form joint ventures. The assembly of all *ejido* members can, in addition, decide on whether lands owned by its members are to be held under communal or individual tenure, and whether *ejido* members have the possibility of making the transition towards fully individual property rights (*dominio pleno*).

A second fundamental set of changes was the replacement of the wholesale prohibition of the ability to exchange land with a more nuanced set of regulations. Land rental was freed completely while sales were allowed within the *ejido* but not -unless the assembly had decided on adoption of *dominio pleno*- with outsiders. A systematic program of land rights regularization served to document existing land rights and to issue legally valid certificates to individual land holders, both to furnish proof of to allow the subsequent exercise of their rights.

Finally, the President's power (and obligation) to grant lands was eliminated and the administration of agrarian justice was separated from the executive and vested with an independent system of agrarian justice. This coincided with the declaration of the end of land redistribution (the "*reparto agrario*") and the establishment of a clear set of rules, including compensation, for expropriation. Reducing the power of the executive and introducing an independent judicial check on the way in which it exercised its power was instrumental in creating the pre-conditions for more secure individual property rights.

Institutional changes involved the establishment of a decentralized and accessible system of agrarian justice, created an independent registry for the social sector, and in the *Procuraduría Agraria*, built a deconcentrated structure to provide legal support to *ejidatarios* and systematically implement the program of property rights regularization.

To allow effective and accessible agrarian justice, a system of 42 *Tribunales Unitarios Agrarios* as well as an appeals court, the *Tribunal Superior Agrario*, were established. Between 1992 and 1999, about 350,000 conflicts were brought before, and dealt with, these Agrarian Courts, thereby eliminating a huge backlog of cases that had accumulated from the past. The *tribunales* are instructed to seek settlements out of court and mechanisms to ensure broad access were put in place.

To facilitate independent verification of property rights, a special registry (*Registro Agrario Nacional; RAN*), with delegations in each of the states, was created. The *RAN* issues, among others, the *certificados parcelarios* which document households' rights to plots that are cultivated individually as well as their

proportional share of common use lands (in case the assembly has decided in favor of common use). In addition, it provides title certificates for urban plots as well as titles of dominio pleno which are subsequently inscribed in the public registry.

Finally, since small farmers who had been under the tutelage of local authorities for a prolonged period of time would still find it difficult to ascertain their rights –especially insofar as past irregularities were concerned- the *Procuraduria Agraria* (PA) was created to provide legal assistance to *ejidatarios*. It does so in three ways, namely (i) by supervising that due process is followed in applying the procedures of the new law; (ii) by assuming an ombudsman function and provides paralegal assistance to ejidos; and (iii) by representing *ejidatarios* in legal proceedings.

All of these elements fed into a program of land regularization (*Procede; Programa Nacional de Certificacion de Derechos Ejidales y Solares Urbanos*), the purpose of which was to resolve boundary conflicts, regularize land tenure, and to issue property rights certificates in a systematic process. This program, participation in which is voluntary, consists of several components that are implemented over a 12 to 18 month period. Following a dissemination campaign, the program allows *ejidatarios* to choose their property rights regime, delineates ejido boundaries, measures individual plots, and eventually issues certificates to individually owned plots (including house plots) as well as communally managed lands to each individual. Procedural safeguards have been put in place to minimize the risks of political maneuvering, in addition to establishing the possibility for appeal to the system of agrarian courts.

In the 6 years of its operation, the program has covered almost three quarters of the country's 30,000 *ejidos* and regularized more than 50 mn has -an area double the size of Spain- issuing certificates to almost 3 million households. Since, in the process, ejidos are also able to accept additional members based on actual occupation, the program resulted in the formal recognition of occupancy rights for more than 1 million households whose land rights were previously limited to insecure possession. Giving title to house plots to about 750,000 *avecindados*¹ in urban areas of the *ejidos* and by regularizing land holdings of 163,605 *posesionarios*,² both of whom had previously very insecure land access, is likely to have had an important equity effect.

2.3 Sample and characteristics of the data

To assess the impact of legal changes separately from their implementation, we use a sample of 351 *ejidatarios* and 75 private farmers in 24 ejidos located in 10 out of Mexico's 32 states. Data was collected by the *Procuraduria Agraria* (PA), with support from the World Bank, between July and Sept. 2000. A

¹ *Avecindados* are individuals who have resided in the *ejido* for at least one year and that have been recognized by the community or by an Agrarian Court.

multi-stage and stratified process of sampling was adopted. In the first stage, rural municipalities that counted with both certified and non-certified ejidos were grouped into 12 clusters based on the extent of rural-urban migration; presence of irrigation; and the average size of landholdings. One municipality was then selected randomly from each of the clusters. In a second stage, two *ejidos*, one that had been certified through *Procede*, and one that had not been certified, were selected randomly in the selected municipalities. For each of these *ejidos*, households were drawn randomly from a list of *ejido* members. To be able to compare with private producers, private farmers were selected randomly from a list of participants in the Government's *Procampo* program.³

Before initiating field-work, historical information on the evolution of area and membership, land conflicts, and productive characteristics of the *ejido* over time, was gathered from secondary sources.⁴ The questionnaires administered to individuals also included retrospective questions on access to credit, i.e. the first and last year in which respondents obtained credit, and a complete history of their involvement in land sales markets. We use this information to construct variables for access to credit and land purchases for the 8 years before and after 1992 as well as the farmer's land endowment in 1984 and 1992. This allows inferences about credit access and involvement in land sales or purchase markets before and after the legal change and/or the adoption of *Procede*.⁵ As the survey did not contain information on access to common property resources, we use household-level information from a panel of 1290 *ejidatarios* who were surveyed in 1994 and 1997, i.e. before and after the adoption of *Procede*,⁶ to deal with this aspect. A more detailed description of this sample, which is based on the 1988 *Ejido Census*, can be found in World Bank (1999).

The remaining gap in productive performance between the private and social sector, together with key characteristics of the sample, is illustrated in table 1. Even though age and household size are similar, there are marked differences between *ejidatarios* and private farmers in land size and quality, ownership of livestock, access to technology (machinery, fertilizer, and modern seed), as well as education and per capita income levels. The median size of land owned by private farmers is 2.8 as compared to 1.2 ha for

² *Posesionarios* are individuals who are recognized by the community to possess *ejido* land yet are not considered *ejidatarios* and therefore do not have many of the corresponding rights. Only the *ejido* assembly (in which only *ejidatarios* have the right to vote) can 'upgrade' a *posesionario* to the status of *ejidatario*.

³ *Procampo* is program that pays a fixed income support on the basis of the area planted to corn and a number of other crops in 1994. Participation in this program is very high, comprising 80% to 90% of all private producers. In view of this, use of the readily available and up-to date *Procampo* lists as a sample frame for the private sector was considered to be preferable to the use of the 1990 Agricultural Census which would have required considerable re-listing.

⁴ The main sources of such information were the *Historial Agrario*, a compendium of legislative actions that assigned land to the individuals that formed the *ejidos*, defined the changes to the *ejido*' borders, and recorded the evictions or additions of members and land (*ampliaciones*) since the *ejido*'s foundation. Productive characteristics were obtained from the *Cedula INDA* (1996), an *ejido*-level census that records the main crops cultivated in the *ejidos*, their extensions, the natural resources to be found in their common lands, and the problems that the *ejidatarios* declared as the most pressing for their communities. For certified *ejidos*, additional information from was available from the administrative records generated in the process of *Procede* implementation. Individual interviews with *ejidatarios* and private farmers were complemented with focus group interviews.

⁵ The underlying assumption is that farmers who report having had their first credit before 1984 did have access to at least one other credit in the period up to 1992. Even though the assumption seems justified, it involves only 4.3 % of the sample; it is thus unlikely to have any impact on the substantive results.

⁶ There were only 15 *ejidos* who had adopted *Procede* already in 1994 and information from these was discarded for the purposes of our analysis.

ejido farmers, while 32% of the private farmers have access to irrigation as compared to 23% in the social sector. The extent of cattle ownership (43% vs. 21%), the average herd size (29 vs. 5.6), and machinery ownership (29% vs. 19%) are all much larger in the private sector where a higher share of producers (43% vs. 28%) uses improved seeds. Even though the fact that information on income was collected in a very aggregate fashion and only in broad categories implies that this information may be quite noisy, it suggests that per capita income in the private sector is higher than in the ejido sector. Private farmers achieve this higher levels of income through higher agricultural productivity rather than diversification into non-farm employment, a fact that is not too surprising given the geographic proximity of the sample households.

A qualitative assessment of the impact of Procede can be gained from the 1997 survey which asked members of the *ejido* directly regarding the perceived impact of Procede. There is relatively strong evidence for Procede to have reduced conflicts and increased social unity in the ejido and some evidence suggesting that it increased activity in factor markets (table 2). At the same time, the impact on credit access and productive investment remained more muted. As highlighted in the table, 28% of respondents felt that Procede reduced the number of conflicts (and 21% that it had increased social unity in the *ejido*) while 5% (and 12%) felt the opposite. Also, 19%, 23%, and 15%, respectively indicated that Procede had increased the number of land rental and sales transactions as well as migration while 12%, 11%, and 8% felt that it reduced these factors. By comparison, the perceived impact on credit access and productive investment remains ambiguous; while 5% believed that Procede had increased investment, 4% believed it had decreased it. Questions included in the 2000 survey (not reported) point into a similar direction: Ejidos without Procede are characterized by a significantly higher presence of conflicts than those with Procede or private land owners (15% as compared to 6%). Certified ejidos also are more likely to have a written internal rule (63% as compared to 30%).

3. Methodology and hypotheses

The variables of interest in our analysis are producers' participation in rental, sales, and credit markets, as well as their use of common property resources. As our data comprise certified and non-certified ejidos as well as private producers, we can compare in three dimensions. First, systematic differences between ejidos and the private sector will allow to identify the gap between these two types of organization. Second, by comparing the same ejidos (and producers within these ejidos) before and after 1992, we are able to identify the impact of the legal changes. Finally, if the implementation of Procede can be considered random, or driven by factors that are not related to subsequent market participation, systematic differences between certified and non-certified ejidos will signify the effect of the program on the variables of interest.

3.1 General framework

With panel data, the general equation to be estimated in order to assess the impact of the ejido reforms on a number of outcome indicators relating to participation in markets for land rental and land sales, as well as credit and ejidatarios' ability to access common property resources has the form

$$(1) Y_{it} = \alpha + \beta X_{it} + v_i + \varepsilon_{it}$$

where Y_{it} is the time-variant outcome variable of interest, X_i is a vector of household specific characteristics, including dummies for whether household i was member of an ejido or not and whether the ejido was certified. In addition to the standard white noise error term ε_{it} , we allow for a second component of the error term v_i that can be thought of capturing household-specific effects. Subtracting the mean of all variables yields an equation of the form

$$(2) Y_{it} - \bar{Y}_i = \beta(X_{it} - \bar{X}_i) + \varepsilon_{it} - \bar{\varepsilon}_i$$

where the household-specific error term v_i has dropped out, thus eliminating the troublesome correlation with the X_i , allowing to obtain unbiased estimates of the coefficients with standard techniques. In this context, two coefficients are of particular interest. The coefficient on an ejido dummy interacted with time will identify the impact of the 1992 constitutional reforms and, similarly, the coefficient on a dummy indicating whether or not the ejido underwent Procede will identify the impact of this program. Depending on the question under concern and the data available, this general framework will have to be modified as discussed below for each topic.

3.2 Land rental markets

Before 1992, *ejidatarios* were prohibited from renting out land under their possession; those violating this rule could have their usufruct right terminated and be evicted. Even though this prohibition appears to have been widely violated (PA 1998), land rental in the “black market” exposed households to risks and social pressures (Heath 1992; Finkler 1978), suggesting that the elimination of the restriction would affect behavior. While after 1992, land rental was legal for all *ejidatarios*, those who had undergone Procede had, in addition, a legally recognized certificate of land ownership. By increasing tenure security for the specific household, this may well have had an impact on the supply of land to the market over and above the legal change.⁷ While we would have liked to estimate an equation with household fixed effects comparing participation in rental markets before and after the legal changes, doing so was impossible

⁷ Such a differential whereby legal provisions remain largely ineffective as long as they are not implemented on the ground has been reported for India (Appu 1996, Banerjee et al. 1999).

because, in view of the illegal nature of rental transactions before 1992, it was impossible to obtain information on this variable. Thus, we estimate an equation of the form

$$(3) \quad N_{it} = \alpha + \beta E_i + \gamma P_i + \delta_0 L_i + \delta_1 E_i L_i + \delta_2 P_i L_i + \mu X_i + \varepsilon_i$$

where N_{it} denotes net operated land, E_i and P_i are dummies for ejido membership and Procede implementation, L_i is the land owned by the household, and X_i is a vector of household characteristics such as age and education of the household head, the number of adult household members, the dependency ratio, a dummy for ownership of machinery, and land improvements.

With constant returns to scale and well-functioning factor and credit markets, the amount of land operated should be independent of the amount of land owned, tenure status, and any other household characteristics. Households would just rent in or rent out land to obtain their optimum operated land area (see Olinto et al. 2000; Pender and Fafchamps 2000) and we would expect the coefficient on own landholding to be zero. By interacting L_i with E_i and P_i , we can thus test for systematic differences in the functioning of land markets between ejidatarios with and without Procede as well as private owners. The idea is that, if the derivative of the land demand function for a specific group equals zero, i.e. if (i) for private farmers $\delta_0 = 0$; (ii) for non certified ejidatarios $\delta_0 + \delta_1 = 0$; and (iii) for certified ejidatarios $\delta_0 + \delta_1 + \delta_2 = 0$ we are unable to reject the hypothesis that land markets work efficiently for this group. Comparing between non-certified and certified ejidos thus provides an implicit way of testing whether adoption of Procede has improved the functioning of land markets. Although we do not know of specific literature on the topic, a priori one would expect that markets function best for private farmers, somewhat less well for certified ejidos, and worst for non-certified ejidos.

While this provides a test for well-functioning factor markets, it does not give a lot of information in case factor markets do not work well. To gain such information, we complement equation (2) with estimation of a tobit equation for the amount of land rented out or rented in, respectively

$$(4) \quad R_i = \alpha + \beta E_i + \gamma P_i + \delta_0 L_i + \delta_1 E_i L_i + \delta_2 P_i L_i + \mu X_i + \varepsilon_i$$

where R_{it} is the amount of land rented in or out (one equation for each case). While our sample includes all ejido members, only operating private *producers* were sampled, implying that private producers who decided to rent out all their land are omitted.⁸ Thus, the equation for renting in land includes all producers, allowing to compare the propensity of private farmers to rent in land as compared to that of ejidatarios with and without Procede. Under the assumption of constant returns to scale and an unequal

⁸ Note that, since we are sampling from a list of all ejidatarios, those ejidatarios who rent out all there land will be included in the sample. This is less likely to be the case for private farmers.

distribution of land ownership, an efficient land market should distribute land from large owners to smaller producers *ceteris paribus*, i.e. the slope parameter should be less than zero. In terms of the parameters we this would imply that $\delta_0 + \delta_1 + \delta_2 < 0$ for certified ejidos; $\delta_0 + \delta_1 < 0$ for non-certified ejidos, and $\delta_0 < 0$ for private farmers. A priori, we would expect these slope parameters to be either negative or insignificant. By comparison, the tobit for renting out land will include only ejidatarios, thus allowing us to identify only the impact of Procede implementation.

3.3 Land sales/purchase markets

There are two reasons for wanting to explore the functioning of land sales markets separately from the market for rental. On the one hand, land ownership, or at least long-term rental, is required to provide an incentive for making long-term investments. On the other hand, imperfections in credit markets and other policy distortions will have a greater impact on sales markets than on rental. Even if land rental markets were to function well, this could lead to undesirable equity effects through speculative land acquisition by wealthy producers with good credit access and distress sales from small landowners who are unable to access credit even for consumption smoothing. It was for this reason that critics feared that the 1992 reforms would lead to massive sales of *ejido* land, thus leading to the dissolution of the ejido sector and undoing the equality of land access achieved in a lengthy process of land redistribution (CAP, 1995; Reunión Nacional de Organizaciones y Movimientos, 1995). Available information suggests that sales have been relatively limited and that, therefore, the fear may not be justified.⁹ To conduct a more rigorous test, we analyze producers' land purchase decisions before and after 1992.¹⁰

To do so, we construct for each of the producers in the sample the amount of land owned in 1992 as well as 1984 (i.e. 8 years before the 1992 reforms), and the amount of net land purchased between 1984 and 1992 (LP_{92}) and 1992 and 2000 (LP_{00}), as discussed earlier.¹¹ Using this as the dependent variable, we estimate a panel regression of the form

$$(5) \quad LP_{it} = \alpha_0 + \alpha_1 t + \beta_0 E_i + \beta_1 E_i t + \gamma P_i + \delta_0 L_{it} + \delta_1 E_i L_{it} + \delta_2 t E_i L_{it} + v_i + \varepsilon_{it}$$

where LP is net land purchases between periods t and $t-1$, and the other variables are as in equation (4) above. Although the above equation can be estimated via OLS, use of an appropriate panel structure is preferable. We estimate both a random and a fixed effects model and use a Hausman specification test to check whether presence of correlation between the household fixed effect v_i and the independent variables. Parallel to what was discussed above, the coefficients β_0 , β_1 , and γ , would identify systematic

⁹ However, the data maintained by the RAN do indicate that, at least as far as registered transactions are concerned, no huge sell-off of land has occurred. It would be nice if we could give some percentages for certified and non-certified ejidos.

¹⁰ We focus on land purchases as the survey does not include farmers who have sold their land and exited the agricultural sector altogether. This is not a great problem since sales out of the ejido sector were still prohibited. Also, use of land sales leads to substantively similar conclusions.

¹¹ We also construct a dummy for ownership of machinery in each of the two periods.

differences concerning participation in land purchase markets between private producers, ejido members before and after the legal change, and ejidatarios with and without Procede, respectively.

3.4 Credit access

Given the low level of productive assets in the ejido sector in comparison to private producers highlighted in the descriptive statistics, higher levels of investment, and access to credit, would be important for productive development of the sector. Indeed, hopes for land certification to increase ejidatarios' access to formal credit were a driving force behind the 1992 reforms. As adoption of *dominio pleno* is contingent on having completed the process of certification, Procede would appear to be a necessary condition for improved credit access. However, remaining restrictions on the marketability of land that formally continue under the *ejido* regime –i.e. without making the transition towards *dominio pleno*– imply that Procede may be a necessary but not sufficient condition for better access to credit markets. The reason is that, though it provides ownership to home lots, it gives only usufruct to agricultural parcels, something that may not be an attractive collateral for formal lenders. If this is the case, the impact of both the legal reforms and the implementation of Procede on credit access may be limited.

To empirically test this, and to check whether, since the 1992 reform, ejidatarios have improved their access to credit compared to private farmers, we estimate the following model:

$$(6) \quad C_{it} = \alpha_0 + \alpha_1 t + \beta_0 E_i + \beta_1 E_i t + \beta_2 P_i + \gamma_0 L_{it} + \gamma_1 t L_{it} + \gamma_2 t E_i L_{it} + \gamma_3 P_i L_{it} + \gamma_4 E_i L_{it} + \delta_0 M_{it} + v_i + \varepsilon_{it}$$

where C_{it} is a dummy equal to one if individual i received credit before ($t=1$) or after ($t=2$) 1992, M_{it} is a dummy equal to one if the individual owns machinery at time t , and L_{it} is the size of landholdings in 1992 ($t=1$) and 2000 ($t=2$). We use this reduced form specification in order to test for systematic differences in the access to credit between ejidatarios and private farmers without delving into the structural functioning of this market. As discussed above, β_0 would indicate systematic differences in credit access between ejidatarios and private farmers, β_1 identifies the impact of the change in the law or other time varying factors on the ejido sector in general, and γ indicates the impact of Procede among ejidatarios, over and above the legal change.

3.5 Use of common property resources

One of the key characteristics of Mexico's ejido sector is the availability of large amounts of relatively marginal common lands (*tierra de uso comun*) which are widely recognized to help low-income households to diversify their income sources and insure against exogenous shocks (Key *et al.*, 1998). In the process of implementing Procede, ejido members could individualize use of these lands (*parcelación*

economica) over and above what had already been cultivated prior to the implementation of Procede (*parcelación individual*). Even though the process was closely supervised, and *de-facto* individualization had been widespread in practice even before the legal changes of 1992 or the formal initiation of the certification process, there were fears that implementation of Procede would allow land-grabbing by powerful ejido members. The literature provides many historical precedents for land titling to be associated with systematic land-grabbing by the powerful (Binswanger et al. 1995) and it was feared that Procede would allow well-connected individuals to have illegal appropriations of common lands that had occurred earlier sanctioned officially. This, it was feared, would convert *de facto* into *de iure* ownership, thereby permanently reducing access to common property resources by the poor who disproportionately depend on these resources as a safety net.

To examine empirically whether access to common property resources within the *ejido* has been affected by Procede, we distinguish three forms of using common property resources with very different characteristics and connotations, namely collection of firewood and other materials, use of pasture, and cutting of forest. Using information from the panel survey mentioned earlier, we can estimate the determinants of households' access to common property resources before and after Procede as follows:

$$(7) \quad A_{it} = \alpha + \beta t + \gamma P_{it} + \delta_0 Hh_{it} + \delta_1 L_{it} + \delta_2 P_i L_{it} + v_i + \varepsilon_{it}$$

where A is a dummy variable equal to one if household i accessed common property resources at time t (before and after Procede), Hh represents household size as well as other characteristics such as the endowments with assets and initial access to common property resources, and L denotes land wealth. As in the earlier equations, we use a fixed effect panel estimator and, for each of the equations, $\gamma = 0$ would imply that Procede had no impact on the access to the common resource by ejidatarios.

4. Empirical evidence

Estimation of the above equations suggests that, while implementation of Procede has been associated with significantly better functioning of land rental markets as well as better utilization of common property resources for pasture, neither this program nor the 1992 constitutional reforms have had a major impact on land sales markets and credit access.

4.1 Descriptive statistics on land markets

Descriptive statistics for land market participation by *ejidatarios* and private farmers, as reported in table 3, appear to support the broader qualitative perceptions discussed earlier. In the rental market, we note a somewhat higher level of activity in certified as compared to non-certified ejidos and a higher level of

renting in, presumably due to higher levels of efficiency, among private farmers. The ability to complement cross sectional evidence with a comparison of changes (in the same ejidos) over time allows to draw more substantive inferences for the case of sales markets. In the aggregate, we see a slight decline in land purchase markets, from 6% to 5%, and a slight increase, from 2% to 4%, in land sales, between the 1984-92 and 1992-2000 periods. Disaggregation allows leads to some interesting conclusions in both cases. For land purchases, the decline for private farmers and uncertified ejidos was countered by a slight increase (from 2% to 3%) in certified ejidos. For land sales, we note a considerable increase for private farmers (from 1% to 5% of the sample) as well as certified ejidos (from 0% to 5% of the sample) but stagnant, if not declining market participation (from 4% to 3%) for non-certified ejidos. There are two conclusions of interest. First, these figures seem to contradict the hypothesis of a greatly increased number of land sales in the ejido sector following the changes in the law, a finding that is even more surprising in view of the fact that, since land sales were prohibited before 1992, one would expect a considerable degree of under-reporting. Second, the descriptive evidence could point towards slightly higher land market activity in certified ejidos, a hypothesis that will be explored more rigorously below.

Evidence on the specific contractual arrangements adopted, which is not reported here as it is documented in detail elsewhere (Robles 2000), point to two characteristics. First, contrary to Central American countries such as Nicaragua where, due to pervasive tenure insecurity, land rental markets are restricted to family members and close friends (Deininger and Chamorro, 2000), such informal ties are of much less relevance in this case, suggesting a higher degree of overall tenure security. Second, in addition to most contracts remaining informal, the virtual non-existence of long-term rental contracts, together with a still very limited land sales market, may be inimical to structural change and land-related investment. This is surprising given the advanced age of many ejidatarios and the scope for longer-term rental contracts to make everybody better off which would suggest that old owners would be able to receive higher amounts of rent payments than they would be able to earn from own cultivation.

4.2 Participation in land rental markets

Regression results for the estimation of equations (2) and (3), respectively, are presented in table 4. The first column contains the results of the analysis of the regression of operated land. To eliminate the impact of outliers which may unduly affect the results in our small sample, we use a median regression, with standard errors obtained by bootstrapping. There are three main findings.

First, the land endowment is highly significant and positive while both the ejido dummy by itself and if interacted with the land endowment, remains insignificant. This suggests that both in the private sector and in non-certified ejidos the amount of land operated is highly dependent on the amount owned, i.e. that markets do not work perfectly. Also, and more surprisingly, once other factors are controlled for, rental

markets did not operate more efficiently in the private sector than in the ejido sector. While we can not exclude the possibility of this finding being due to the sample size in the private sector and therefore recommend that it be confirmed with a larger number of observations, this may point to the presence of tenure insecurity in the private sector.¹²

Second, the coefficient on the Procede dummy is positive and the coefficient on this dummy's interaction with the land endowment, is negative and significant. This implies that implementation of Procede has increased the demand for operated land and, by decreasing the dependence of operated on owned land, has helped improve the functioning of rental markets. In fact, we can not reject the hypothesis that in certified ejidos, but not in non-certified ones, the average household was able to rent in whatever amount of land they wanted, independently of their initial endowment, thereby adjusting to reach the optimal operational size.

Finally, the presence of improvements on owned land, which can also proxy for the farmer's unobserved managerial ability, is positive and significant. This could imply that lack of explicit provisions in rental contracts to protect existing investments may act as a disincentive to rent out land that has associated investments. By comparison, neither ownership of machinery nor household characteristics are significant. The positive impact (at 10%) of the receipt of Procampo payments could imply that, during the period under concern, farmers were credit constrained and the cash payment thus received were used to acquire working capital.

If the adoption of Procede were correlated with unobserved factors that would lead to higher participation in land rental markets, the coefficients on this dummy (and the whole regression) would be biased. As the small sample of only 24 ejidos does not allow robust inferences on this issue, we used the 286 ejidos included in the FAO surveys described above to test whether the probability to adopt Procede depends on the initial level of rental activity within the ejido. The presence of such correlation is rejected (Deininger and Bresciani, 2001), supporting circumstantial evidence that implementation of Procede was driven more by bureaucratic imperatives of rapidly achieving high levels of coverage, than by demand from ejidos where the scope for the program to make a big impact was particularly high.

Estimates from the tobit regression for land rented in or out in table 3 provide additional insights into the operation of land rental markets and the impact of Procede on the functioning of these markets, especially the differences between certified and non-certified ejidos. The coefficient on the ejido dummy is negative and significant while this dummy's interaction with land is positive in non-certified ejidos while the opposite is true in certified ejidos (all coefficients are significant at the 1% level). On the one hand this

¹² Such tenure insecurity could encourage households to buy (where subsequent challenges to property rights are less likely), rather than rent, with negative consequences for poor households who, while possibly being able to rent, may not be able to get access to the credit needed to buy land, a hypothesis that would merit further investigation.

suggests that, in line with the descriptive evidence, the demand for renting in land is higher in certified than in non-certified ejidos, supporting the hypothesis that Procede has improved the functioning of land rental markets. On the other hand, it implies that, even though the structure of land ownership is quite similar in both types of ejidos, rental markets work completely differently in each of them— in non-certified ejidos it is the large farmers who rent in land and the small farmers who rent out while the opposite is true in certified ejidos.¹³

Thus, in non-certified ejidos, the rental market thus tends to contribute to land concentration instead of (as expected *a priori*) redistribution towards smaller producers. If results from other countries pointing towards an inverse farm size-productivity relationship (Bardhan, 1973; Barrett, 1996; Carter, 1984) can be transferred to the Mexican situation, this would imply that in this situation, rental markets might actually *decrease* efficiency. By contrast, in certified ejidos, the exact opposite is true—the rental market is more active and distributes land towards those with lower endowments of owned land. This is consistent with the hypothesis that the implementation of Procede, rather than the legal changes by themselves, increased tenure security and, by allowing small land owners to increase their operational holding size through rental, helped to bring about efficiency-enhancing land transfers.

The truncation problem created by the fact that landowners in the private sector who rented out all their land are, in contrast to ejidatarios who did so, unlikely to be observed, forces us to restrict estimation of renting *out* to ejido members. Column 3 of table 4 presents the results of estimating the corresponding tobit equation (note that a negative sign means higher supply of land to the rental market). The negative and significant coefficient on the Procede dummy and the negative though insignificant point estimate on its interaction with land endowments suggest that, in line with what was found earlier, certification increases land supply to the rental market, especially by large land owners. In addition, ownership of machinery significantly reduces the amount of land rented out.

To summarize, at least insofar as the rental market and operational land holdings are concerned, there is little foundation to claims that the 1992 policy reforms and the implementation of Procede favored land concentration. Instead, certification of land rights appears to have increased overall demand for cultivated land and allowed small producers to enter the market on the demand side. As noted earlier, it is remarkable that land rental markets seem to have been affected by Procede implementation rather than the changes in the legal framework. In fact, it appears that legal changes by themselves were ineffective and that systematic implementation was needed to make a difference regarding the operation of the market.

From a policy perspective, this raises two issues. First, even though care should be exercised to not draw far-reaching conclusions from a very small sample of private producers, the fact that rental markets

¹³ The presence of improvements on owned land is likely to be correlated with the operator's (unobserved) managerial ability.

function better in certified ejidos than in the private sector could suggest that the extent to which lack of titles and associated tenure security in the private sector may be worth exploring further. This is in line with evidence from case studies (Robles 2000) and could suggest that avenues to improve the status of public property registers may warrant attention. At the same time, the almost universal prevalence of short term contracts, even in the ejido sector, suggests that activation of the land rental market alone may not be sufficient to allow an optimal adaptation to the structural change that is likely to be required for Mexico's agricultural sector in the future. Short term land rental contracts do not provide sufficient security to make long term plans and the investments required to improve the productivity of the land, be they land related (e.g. irrigation, perennial, etc.) or of a more general nature (e.g. mechanization, packing plants, and marketing arrangements). Unless land purchase markets allow rural producers to make these adjustments, an issue that will be examined below, ways to encourage long-term contracts and/or remove obstacles that would at present prevent their wide-spread use, will be an important item on a policy agenda building on the accomplishments achieved under Procede.

4.3 Participation in land sales markets

The results of estimating equation (4) for the amount of land purchased are reported in table 5. Net purchases of land in both the pre-1992 and the post-1992 period are constructed using individuals' transaction history. Estimating the model reported in the first two columns under the hypothesis that individual effects are random delivers an estimate of the variance of the individual effects equal to zero, implying that we could correctly estimate the model by OLS without taking deviations from the means. This does not eliminate the need to control for unobservable individual effects that are likely to influence land purchase decisions and results under the assumption that these effects are fixed are reported in columns three and four. Interpretation of the analysis relies on both sets of results as OLS allow to infer the influence of landholdings whose variability over time is too low to display any significance in the transformed fixed-effects model.

First, the data reject the notion that the both the 1992 reform – permission to sell land to other ejido members – and Procede as an additional factor have resulted in a massive sale of land. Being an ejidatario does not result in a higher participation in the land market, whether one belongs to a certified or non certified ejido and independently of the time period considered (i.e. before or after 1992). Thus, the reforms did not lead to a wave of land sales as detractors of the reforms feared¹⁴. Second, there is evidence that since the reform land purchases have decreased irrespective of the tenure status. This is consistent with the notion of a stagnation in the agricultural sector, possibly due to the restructuring of the credit system or to a overall depression of the sector's profitability following the removal of government

¹⁴ Other factors such as ownership of machinery and access to irrigation have a significant and impact as well.

interventions in commodity and input markets and as a consequence of the reduction of tariff protection following the liberalization of the sorghum market and NAFTA (Mhyre, 1998). Third, we note that net purchases of land are negatively related to the amount of owned landholdings, independently of tenure status. This clearly leads us to reject the hypothesis that sales markets have led to land concentration. Finally, the regression suggests that *Procede* did not have an appreciable impact on land sales market activity, in contrast to its impact on land rental markets.¹⁵ In interpreting the result, one has to bear in mind that, by aiming to compare certified with non-certified ejidos, our sample is not nationally representative but instead over-emphasizes relatively marginal areas with a presence of non-certified *ejidos*. Bearing this limitation in mind, our findings nonetheless support the conjecture that, as generally reported in the literature, it is more difficult to activate land sales markets than to get land rental markets going. Where sales of ejido lands are likely to be important in the future, i.e. especially in peri-urban areas, it is therefore important to make all participants aware of their rights in order to achieve outcomes that are satisfactory from an efficiency and an equity perspective.

4.4 Credit access

Table 6 provides descriptive statistics regarding credit access, for the whole sample and for the sub-groups of interest. One notes that there has been a general decrease in credit availability, with 22% of producers having received credit in the 1992-2000 period, compared to 25% during 1984-92. While the descriptive statistics suggest that the decrease in credit use was slightly lower in certified than in non-certified ejidos, they also caution against premature conclusions from cross-sectional evidence; as illustrated in table 6, certified ejidos seem to have had slightly higher credit access already before introduction of *Procede*, suggesting that other factors may be at play as well.

Complementing the statistics on aggregate credit use with evidence on the modalities of such credit for the different groups during the 1999/00 season suggests that the modalities under which certified ejidatarios are able to access credit are similar to those in the private sector, and somewhat better than those available to members of non-certified ejidos. Even though most of the credit obtained was for the short term, between 13% and 14% of private farmers and certified ejidatarios (as compared to 7% in the non-certified sector) had access to long-term credit. Also, while 44% of non-certified ejidos accessed credit as a group, the corresponding percentage for private farmers and certified ejidatarios was only 27% and 29%, respectively. Certified ejidatarios' access to private credit (i.e. buyers and commercial banks) is higher than for non certified ejidatarios (9% versus 4%), although below that of private farmers (14%). Despite the legal limits on the ability to use land as a collateral, 27% of certified ejidatarios (vs. 50% of private sector producers and 4% in non-certified ejidos) used land as a collateral for obtaining credit. The

¹⁵ The fact that *Procede* is insignificant not only in the panel but also in the OLS regression suggests that this is not a function of the estimation

use of land by ejidatarios as a guarantee for obtaining credit is likely to reflect the practice by rural banks to take possession of land titles as a mean to exert pressure on the borrower rather than of insuring effectively against borrower's default.

Are the suggestions emerging from descriptive analysis borne out by more rigorous analysis? Results on credit access from a pooled probit (columns one and two) and a fixed effects logit are presented in table 7. As in the case of land sales market participation, we note a highly significant and quantitatively important decrease in the probability of accessing credit over time, even in the fixed effects regression. Second, there is *no* difference between ejidatarios and private land owners once other factors such as ownership of other assets that can function as collateral substitute are controlled for. This suggests that, during the period under concern, land tenure in the ejido sector was not the main constraint to credit access.¹⁶ *Procede* is not found to have a significant impact either, suggesting that the ability to use the usufruct to a well-demarcated parcel of land as collateral did not increase ejidatarios' ability to access formal sources of financing¹⁷. Finally, and somewhat surprising, the amount of land owned does not affect access to credit, suggesting that reduced availability of credit affected the whole sector, rather than only a limited segment of small producers.

During the period under concern, it was not the lack of individual title, but the combination of a financial crisis with insufficient asset endowments which seems to have prevented increased credit access by ejidatarios and private farmers alike.¹⁸ Although this does not preclude the possibility that, as the financial system recovers, the lack of fully transferable ownership rights may become of importance and measures to reduce the transaction costs of making the transition to *dominio pleno* (e.g. by allowing households to make the transition unless the assembly objects within a given time period instead of requiring a decision by the assembly to enable them to do so) might be required, at present this does not appear to be the most binding constraint.

4.5 Use of common lands

We consider three categories of use of common lands, namely collection of forest products (mainly for household consumption purposes); use of pastures for grazing animals; and cutting of trees and discuss them in turn. Table 8 reports the results of the estimation of equation (6) using a random and fixed effect logit estimator, respectively. Since, in this specification, only households whose forest use changed over time contribute to the likelihood function, the number of observations is limited to 173, 243, and 167,

technique.

¹⁶ This is in line with the finding that, even among those who had undergone *Procede*, the 1997 survey found very few households (20%) who claimed to be interested in getting *dominio pleno* in order to increase their access to credit.

¹⁷ This does not exclude the possibility that certified ejidatarios' land can be used as a valuable collateral for accessing informal credit.

¹⁸ We also note that, over time, ownership of ejido land contributed to a slight increase in the ability to access credit. Although this could suggest that the 1992 reforms increased households' ability to use land as a collateral, a more likely explanation is that the coefficient captures the impact of credit programs that were specifically directed towards the ejido sector.

respectively, out of the total of 1267. Tests of the random error against the fixed effects specification for each equation using a Hausman specification test reject the former in each case. We therefore focus in our interpretation on the latter.

The probability of households using common lands for grazing of animals (column 1) has increased over time, as illustrated by the positive time effect. This is likely to be a consequence of less intensive cultivation in the wake of worsening crop prices following the removal of the guarantee prices and the liberalization under NAFTA. In addition, *Procede* is estimated to have had a significant and positive impact on access to pastures, consistent with the notion that in the process of certification, *ejidatarios* are more likely to formulate rules to govern the access to common lands and to establish an effective institutional framework that can actually enforce such rules (Zepeda, 2000). This is of particular interest in view of the fact that, due to partial individualization, *Procede* was in almost all cases associated with a decrease of the total area under common lands (Procuraduría Agraria, 2000). It would be of interest to explore to what extent such enhanced equity in access has been associated with greater efficiency in resource use.

Both random and fixed effect regressions for gathering of forest products suggest that use of such products has increased between 1994 and 1997, pointing towards a general crisis in the rural sector. The *Procede* dummy remains insignificant, suggesting that this intervention has neither increased nor decreased households' propensity to rely on common property resources. Even though household characteristics change little over time, we find that larger households have increased their reliance on common property resources, supporting the role of such resources as a buffer against shocks (e.g. return of family members who lost their migrant job). In addition, the random effects regression highlights that education and land ownership decrease the level of utilization of common property resources, as expected.

Finally, as an (admittedly imperfect) proxy for environmental conservation, we introduce the number of households who rely on logging in common forests.¹⁹ As table 8 illustrates, the number of people engaging in this activity has decreased markedly between the two periods. At the same time, there is no significant difference between certified and non-certified ejidos. The regression suggests, however, that more educated households have decreased reliance on logging, illustrating the importance of alternative employment opportunities. Concerning the design of *Procede*, this would imply that, while the program has been effective in increasing access to common pastures, it has not had major impact on conservation of forest resources, in line with the fact that, at the ejido level, it is easier to internalize the externalities

¹⁹ As the question refers to the number of households engaging in logging rather than to the intensity of this activity, this may not map directly into the degree of environmental conservation.

arising from overuse of common pastures than those from forests. Also, fears that Procede may restrict or eliminate access to common property resources by the poor, appear to be unjustified.

5. Conclusion and policy implications

Our analysis of the constitutional reforms undertaken in Mexico in 1992, as well as the systematic implementation of a program to regularize land rights leads to four main conclusions. First, we find that land rental markets operate very differently in certified as compared to non-certified ejidos. This can be interpreted as an impact of the program of regularization only if the assignment of the program was random. Even if this is not the case, the fact that almost equal differences are found between the private sector, together with the inability to find a correlation between implementation of Procede and initial land rental market activity, suggest that Procede has created the preconditions for better functioning of markets for land (rental) in rural Mexico. This is important, given that demographic changes and economic growth in the non-farm sector are likely to result in significant structural change in the future.

At the same time, the fact that land rental markets appear to work less well in the private sector than in certified ejidos, together with the fact that long-term contracts have been slow to emerge, suggests areas where government action might be useful in a number of areas. These include the provision of information and the reduction of institutional and possible regulatory barriers that might prevent producers from entering into longer term contracts. Taking measures that would insure not only that private producers enjoy the degree of tenure security available to certified ejidatarios, and to ensure the maintenance and updating of the information generated through Procede would be of high importance.

The finding that Procede has increased households' access to common land for pasture suggests that the transparent, accountable, and participatory process has succeeded in overcoming many of the obstacles that often prevent systematic and quick implementation of a regularization program in rural settings. In view of the fact that the *ejidos* that remain to be covered by the program are characterized by larger extensions of common property resources and higher incidence of boundary conflicts, it may be useful to strengthen this process in key areas, such as conflict resolution, building on the considerable expertise built up thus far and adding elements of environmental protection which, according to our estimates, has not thus far not been improved by the implementation of Procede.

By comparison, our data do not support the hypothesis that either legal changes or the implementation of Procede have systematically affected the way in which land sales markets operate. This implies that fears of a wave of land sales did not materialize. At the same time, and in line with anecdotal evidence suggesting that, non-transparent conditions in sales markets have led *ejidatarios* in peri-urban areas to

forgo many of the potential gains from the program, this would suggest that measures to improve the functioning of markets may be appropriate.

Finally, we also find that, for the sample and the time period under concern, there was little tangible impact of Procede on the functioning of factor markets. Although this is consistent with the interpretation that remaining restrictions on the ability to mortgage land preclude participation of certified as well as non-certified ejidatarios in credit markets, the failure to find any appreciable difference between ejidatarios and private farmers, may point towards a more generalized scarcity of rural credit as the main reason underlying the lack of credit access. Even though lack of collateral may, under current conditions, not be the most important constraint for ejidatarios' ability to access credit, creation of an institutional environment to reduce the transaction costs of making the transition to *domino pleno* would still be warranted.

Overall, our analysis suggests that Procede has been an important element in a strategy to improve the functioning of factor markets. To translate this into a more comprehensive assessment of the costs and benefits of the program, a more specific assessment of Procede's impact on household welfare would be needed. While clearly transcending the scope of this paper, such an assessment would be important to complement the present analysis and to identify some of the channels through which the changes in factor markets observed here came about.

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Table 1: Characteristics of ejidatarios and private farmers included in the survey

	All farmers	All ejidatarios	Private farmers	Ejidatarios w/o Procede	Ejidatarios with Procede
Household characteristics and income					
Household size	4.11	4.06	4.36	4.32	3.84
Age of household head.	40.63	40.91	39.32	39.88	41.75
Mean education of household head (years)	4.61	4.27	6.23	4.25	4.29
Per capita household income (median)	3,771	3,771	5,280	3,771	3,300
Households earning less than a minimum wage (%)	38.0%	40.0%	25.0%	35.0%	44.0%
Share of household income from agriculture	58.0%	59.0%	57.0%	54.0%	62.0%
Share of households receiving remittances	20.0%	22.0%	15.0%	23.0%	21.0%
Endowments					
Per capita land owned (median)	1.56	1.40	3.00	1.25	1.42
Per capita agricultural land (median)	1.32	1.20	2.78	0.75	1.42
Irrigation available	25.0%	23.0%	32.0%	17.0%	28.0%
Share of agricultural land with irrigation	0.28	0.27	0.33	0.17	0.33
Cattle ownership (%)	24.0%	21.0%	43.0%	18.0%	23.0%
Avg. herd size (for cattle owners)	9.73	5.62	29.00	6.57	4.2
Ownership of ag. Machinery/ equipment	21.0%	19.0%	29.0%	20.0%	18.0%
Agricultural technology					
Used fertilizer	41.0%	40.0%	48.0%	43.0%	37.0%
Used improved seeds	31.0%	28.0%	43.0%	23.0%	32.0%
Used rented/ owned machinery	34.0%	31.0%	45.0%	30.0%	32.0%
Median Corn Yields (kg/ha)	929	897	1050	1000	750
Median Wheat Yields	4274	3875	5000	4000	3375
Number of observations	426	351	75	157	194

Source: 2000 Ejido and private farmer survey.

Table 2: Subjective perceptions regarding the impact of Procede

	Change due to Procede	
	.. More	.. Less
Tenure security and factor market participation		
Problems with land tenure security	5.0%	28.0%
Rental of lands	19.0%	12.0%
Land Sales	23.0%	11.0%
Migration	15.0%	8.0%
Access to credit	12.0%	8.0%
Productive investments	5.0%	4.0%
Ejido characteristics		
Social unity in the ejido	21.0%	12.0%
Participation in associations	5.0%	4.0%
Land consolidation	3.0%	2.0%
Land subdivisions	4.0%	2.0%

Source: 1997 Ejido survey (based on 1291 ejidatarios)

Table 3: Land market participation by ejidatarios and private farmers.

	All farmers	All ejidatarios	Private farmers	Ejidatarios w/o Procede	Ejidatarios with Procede
Land rental market					
Rents land in	10%	9%	16%	6%	11%
Rents land out	15%	16%	9%	18%	14%
Land Sales Market					
Bought land between 1984 and 1992	6%	4%	16%	6%	2%
Bought land between 1992 and 2000	5%	4%	11%	4%	3%
Sold land between 1984 and 1992	2%	2%	1%	4%	0%
Sold land between 1992 and 2000	4%	4%	5%	3%	5%
Use of common property resources (CPR)					
Use of CPR for pasture in 1994		14%		14%	18%
Use of CPR for pasture in 1997		28%		24%	37%
Use of CPR for gathering in 1994		25%		26%	7%
Use of CPR for gathering in 1997		35%		29%	46%
Use CPR for logging in 1994		21%		22%	4%
Use CPR for logging in 1997		9%		10%	7%

Source: Ejido and private farmer survey, 2000; 1994 and 1997 ejido surveys

Table 4: Determinants of operated land and land rental market participation

	Quantile regression Net operated land	Tobit Net renting in	Tobit Net renting out
Endowment of agricultural land	1.501** (2.37)	-0.146 (0.49)	
Ejido dummy	3.624 (0.81)	-203.788*** (2.98)	
Ejido dummy *Land endowment	-0.954 (1.35)	18.087*** (8.72)	
Procede dummy	1.358** (2.00)	287.133*** (4.62)	-6.036** (1.98)
Procede dummy * Land endowment	-0.422** (2.35)	-37.704*** (3.93)	-0.208 (1.45)
Owns machinery	1.078 (1.13)	2.734 (0.06)	7.602** (2.02)
Improvements on owned land	1.128** (2.18)	107.233** (2.47)	-1.288 (0.44)
Received Procampo	1.540* (1.89)	22.877 (0.45)	-5.454 (1.59)
Age of household head (years)	0.007 (0.42)	0.784 (0.62)	0.009 (0.12)
Education of head (years)	0.016 (0.21)	4.583 (0.68)	0.554 (1.30)
Number of adults	0.057 (0.76)	4.177 (0.71)	-0.143 (0.30)
Dependency ratio	0.350 (0.34)	52.584 (0.51)	-7.598 (0.99)
Constant	-5.428 (1.19)	-314.007** (2.41)	23.372*** (2.86)
No. of observations	358	327	283
Pseudo R-squared	0.451	0.155	0.200

*** significant at 1%; ** significant at 5%; * significant at 10%.

Absolute value of t-statistics in parentheses.

Table 5. Determinants of net land purchases, 1984-1992 vs. 1992-2000.

	(1) Pooled OLS	(2) Pooled OLS	(3) Fixed effects	(4) Fixed effects
Time dummy	-6.205 (1.32)	-6.190 (1.32)	-10.724* (1.80)	-10.723* (1.80)
Ejido dummy	-4.257 (0.94)	-3.365 (0.78)		
Ejido*time	6.267 (1.13)	5.877 (1.12)	10.454 (1.48)	10.100 (1.50)
Procede	0.751 (0.30)	0.653 (0.26)	0.762 (0.18)	0.744 (0.17)
Land holdings	-0.049*** (4.19)	-0.048*** (4.15)		-0.377 (0.38)
Ejido *Land	0.102 (0.64)		-0.352 (0.35)	
Time*Ejido *Land.	-0.052 (0.27)		-0.041 (0.17)	
Constant	3.592 (0.78)	3.605 (0.78)	3.298 (0.42)	7.448 (0.41)
Observations	393	393	393	393
No of households		226	226	226
R-squared			0.02	0.02
Adjusted R-squared	0.0476	0.0514		

Absolute value of z-statistics in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Access to credit markets by ejidatarios and private farmers.

	All farmers	All ejidatarios	Private farmers	Ejidatarios w/o Procede	Ejidatarios with Procede
Credit market access					
Obtained credit during 1984-92	25%	23%	35%	20%	25%
Obtained credit during 1992-2000	22%	20%	29%	17%	23%
Type of credit obtained (last year **)					
Short term	82%	83%	77%	93%	78%
Long-term	12%	11%	14%	7%	13%
Individual	62%	60%	68%	56%	62%
In group	33%	35%	27%	44%	29%
Credit source (last year)					
Banrural	36%	32%	50%	11%	44%
Commercial Bank	4%	1%	14%	0%	2%
Buyer of produce	4%	6%	0%	4%	7%
Collateral used					
Land	26%	18%	50%	4%	27%
Harvest	4%	6%	0%	15%	0%
Animal	1%	0%	5%	0%	0%
Machinery	6%	8%	0%	4%	11%
Other	3%	4%	0%	4%	4%
Rejection of credit					
Solicited credit after 1992 and was rejected	11%	10%	13%	13%	9%
Lack of collateral	16%	14%	20%	16%	13%
Not affordable	13%	3%	50%	0%	6%
Insufficient project quality	11%	11%	10%	21%	0%
Personal/ political	7%	9%	0%	5%	13%
Unpaid credit	4%	6%	0%	0%	13%

Source: 2000 Ejido and private farmer survey.

Table 7: Access to credit before and after 1992

	Pooled		Panel Fixed effects
Time dummy	-0.379** (2.45)	-0.332*** (4.14)	-2.667** (2.31)
Ejido dummy	-0.111 (0.75)		
Procede dummy	-0.074 (0.64)	-0.087 (0.85)	-3.713 (1.51)
Time*Ejido	0.052 (0.26)		
Owns machinery	0.258*** (5.22)	0.256*** (5.17)	2.531** (2.25)
Land owned in ha (log)	-0.007 (0.20)	0.012 (0.58)	-2.554 (0.68)
Time* land	0.057 (1.38)	0.044* (1.83)	0.195 (0.55)
Time*ejidatario*landhold.	0.019 (0.29)	0.037 (1.29)	0.289 (0.76)
Procede*landholdings	0.017 (0.31)	0.023 (0.44)	1.637 (1.62)
Ejido*landholdings	0.033 (0.68)	0.002 (0.09)	6.010 (1.12)
Constant			
No of observations	563	563	132
Number of households			66
Log-likelihood	-219.8658	-220.16052	-24.153117

Robust z-statistics in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: Determinants of common land access, 1994 and 1997

	<i>Use of common land for pasture</i>		<i>Use of forest products</i>		<i>Forest logging</i>	
	Fixed effect	Random effect	Fixed effect	Random effect	Fixed effect	Random effect
Time dummy	0.538** (2.44)	0.666*** (4.62)	1.026*** (3.92)	0.598*** (3.47)	-0.730*** (2.80)	-1.425*** (8.64)
Procede dummy	0.965** (2.06)	-0.200 (1.03)	-0.101 (0.18)	-0.758*** (3.56)	0.533 (0.97)	0.044 (0.18)
Household size (persons)	0.051 (0.81)	0.032 (1.43)	0.135* (1.65)	0.061*** (2.61)	0.146* (1.78)	-0.002 (0.06)
Age (years)	0.034 (0.98)	-0.003 (0.57)	-0.029 (0.67)	-0.013*** (2.62)	-0.050 (1.16)	-0.003 (0.66)
Education (years)	-0.095 (0.94)	-0.006 (0.53)	-0.189 (1.24)	-0.043** (2.16)	-0.305** (2.11)	-0.008 (0.41)
Land owned (ha)	-0.012 (0.83)	-0.010 (1.34)	-0.004 (0.33)	-0.021*** (2.86)	0.008 (0.52)	-0.016** (2.48)
Land*Procede	-0.035 (1.04)	-0.017 (1.16)	0.013 (0.25)	-0.006 (0.35)	-0.048 (0.88)	-0.023 (1.10)
No of cattle	0.020 (1.04)	0.033*** (5.37)				
Cattle * Procede	0.085* (1.76)	0.006 (0.58)				
Common land %	-0.005 (1.32)	0.001 (0.84)				
Common land* Procede	-0.002 (0.83)	0.001 (0.50)				
Percent Forest			0.000 (0.05)	0.008*** (3.15)	0.007 (1.00)	0.011*** (4.56)
Percent * Procede.			0.004 (0.38)	0.023*** (3.16)	0.002 (0.23)	0.012** (2.34)
Constant		-2.078*** (2.59)		-0.744 (0.88)		0.842** (2.14)
No of observations	486	1908	346	1718	334	1718
No of households	243	1288	173	1289	167	1289

* significant at 10%; ** significant at 5%; *** significant at 1%.

Absolute value of z-statistics in parentheses.