Recrafting Rights over Common Property Resources in Mexico*

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I. Endogenous Evolution of Land Rights

The propositions of Ester Boserup and the Property Rights School have dominated thinking about the endogenous evolution of land rights from open access to individual property.[1] According to these views, there are two fundamental changes that push toward the privatization of a resource. One is its rising scarcity associated with population growth. The other is the rising value of the resource associated with greater market integration and the commercialization of agriculture. As long as there was land abundance and the resource had little commercial value, the marginal cost to current users of entry by an additional user was sufficiently small not to be worth opposing, and the magnitude of the externalities imposed in extraction by each user on all others was insignificant, making it not worth controlling.

As the scarcity and value of the resource increases, changing property rights to regulate entry and to internalize the externality imposed by other users becomes profitable. Regulating entry requires transformation of the resource from open access to common property or to private property, limiting in each case access of the resource to a well-defined group of users.[2] Internalizing externalities requires choosing between two options. One is to cooperate in the management of the common property resource (CPR) by introducing and enforcing rules that deter opportunism in the provision of services to the CPR and in the appropriation of resources from the CPR.[3] The other is to divide the CPR among members of the community, either in subcoalitions where cooperation may prevail more easily or in individual allotments.[4] The default option prevails when there is failure to enclose, failure to cooperate in the management of the CPR, and failure to enforce individual

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property rights after division. In this case, incentives to manage the resource for sustained use are missing, and there is both underprovision of services for maintenance and overextraction from the resource, leading to degradation and depletion, the well-known "tragedy of the commons."[5]

Recent contributors to the New Institutional Economics of property rights have attempted to identify conditions under which the CPR option was eventually chosen over the division option.[6] There are basically four situations that can lead to this outcome. The first is when there are high expected benefits from keeping the land in CPR as opposed to dividing it into individual plots. These advantages derive from economies of scale in production, geographical risk spreading over large areas, and benefits of maintaining the land in common as the basis for community life, which provides, in turn, other advantages such as information sharing, mutual insurance, and political clout.[7] The second is when the community is able to maintain a low-cost governance structure and effective cooperative relations among members. From the logic of collective action, we know that this is related to structural characteristics of the resource, the community, and the context where cooperation occurs, and there has been some empirical work to quantify the relative importance of these determinants of cooperation.[8] The third is when the high costs of privatizing overwhelm the expected gains. This is the case when the costs of negotiating division and of enforcing individual property rights are too high. Finally, there are situations where concerns with unequal gains from privatization, and lack of commitment devices to make credible that compensations will be paid to compensate for unequal gains, prevent mobilizing support in favor of division.[9] Division may thus be opposed by those currently making greater use of the CPR (e.g., large livestock owners) or by those who fear low allocations when division will occur. Hence, there are many reasons why the CPR option may be chosen over division in spite of population pressure and market development. These CPRs are sometimes well managed but more often overexploited and poorly maintained, continuing to exist as a dysfunctional institution blocked from further evolution along the lines predicted by Boserup.[10]

Much of the empirical evidence in support of these evolutionary paths is qualitative because we rarely have a sufficiently large number of observations on the institution being transformed to engage in statistical analysis. D. North, R. Wade, and E. Ostrom, for instance, provide us with fascinating case studies of how particular communities have responded to the pressures of increasing resource scarcity and increasing value of the resource, inducing transformation of property rights.[11] Only recently have K. Otsuka and F. Place conducted systematic empirical studies in seven countries to identify quantitatively the role of different factors explaining the privatization of communal tenures.[12] They find that population pressure (rising land scarcity) has been the main determinant of privatization of land rights.

In this article, we turn to Mexico's recent experience with recrafting property rights over its extensive CPRs as a unique opportunity to analyze in great detail, both qualitatively and quantitatively, the determinants of the

endogenous evolution of land rights. In that country, the peasant-led revolution of 1910 resulted in an extensive process of land reform that distributed half of the nation's agricultural land to 29,162 peasant communities called *ejidos*. Members of these communities (called *ejidatarios*) received access to an individual land parcel, principally cultivated in crops, and to land held in common property, mostly kept in pastures and forests. In *ejidos* where agriculture is practiced as shifting cultivation, all land is often held communally.

The legislation that created the *ejidos* severely constrained the *ejidatarios*' property rights over land. This is not surprising since the overriding objective of the land reform was to avoid recurrence of peasant-led uprisings.[13] Land transactions involving individual parcels were prohibited: no rental and sales were allowed. It was illegal to divide common property areas into individual plots. Membership in the *ejido* was also tightly controlled. Any request for the incorporation of new members had to be submitted to the Agrarian Reform Agency, which had the policy of curbing membership expansion to avoid reducing the land area per member and the potential return of revolutionary demands for land. The same goal was behind the restriction imposed on *ejidatarios* to bequeath their individual land parcel and their right to the commons to a single descendant. As a consequence of this restriction, the village in an *ejido* typically contains many nonmembers, mainly the nonheir sons and daughters of members with no rights of access to *ejido* land.[14]

The 1992 constitutional reform of property rights gave *ejidos* the freedom of reallocating land between common property and individual parcels, as well as of incorporating new members, provided specific procedures were followed. The land certification program PROCEDE (Programa Nacional de Certificación de Derechos Ejidales y Titulación de Solares Urbanos, or, the National Certification Program of *Ejido* Rights and Urban Lots), initiated in 1994, provided the means to implement these changes. A new agency, the Agrarian Attorney's Office, led the certification effort through organizing introductory meetings, providing guidance during the required assemblies, and helping in the process of defining and registering individual plots. While not free from struggles and confrontations as can be expected from changes in rules governing the commons, the process was remarkably transparent and democratic due to rules imposed by PROCEDE.[15] Such rules required a majority vote to initiate the program, active role of a commission of the assembly in the identification of individual parcels, public posting of land assignments to accommodate disagreements, signed recognition of boundaries by owners of lands surrounding the *ejido*, and majority approval (with a 75% quorum) of the revised property rights needed for the Agrarian Land Registry to issue certificates. This sudden reform of property rights in Mexico gives us an exceptional observatory of the endogenous process of preservation or division of CPRs, and incorporation or not of new members in the community.

It is this endogenous process of division and incorporation that we analyze in this article. Specifically, we want to (1) identify the factors explaining community decisions over changes in property rights (division and incorpo-

ration), discriminating in particular among different hypotheses advanced in the literature, and (2) follow the implications of endogenous changes in property rights over individual access to land and how they affect poverty and inequality. We use for this purpose a nationwide panel of *ejidos* and *ejidatarios* conducted by the Agrarian Reform Agency, the University of California, Berkeley, and the World Bank. The first survey was done in 1994 before implementation of PROCEDE. By the time of the second survey in 1997, nearly two-thirds of the *ejidos* had at least initiated the land certification program. The surveys give us information about changes in property rights (division) and in membership (incorporation) at the *ejido* level and also about changes in household-level land endowments within the *ejidos* surveyed. In-depth case studies of *ejidos* were also conducted in 1999 to understand the motivations for a community in deciding to divide and incorporate or not and to whom to allocate additional land.

The remainder of the article is organized as follows. In Section II, we use the literature on enclosure of the commons to derive a number of hypotheses for the specification of the empirical analysis of division and incorporation, and, in Section III, we use case studies conducted in 12 *ejidos* to understand causalities in the changes observed. In Section IV, we present the results from the *ejido*-level empirical analysis of the decisions to divide and incorporate; in Section V, we analyze the determinants of changes in land endowments at the household level to derive implications for poverty and inequality; and we extract conclusions in Section VI.

II. Hypotheses on the Determinants of Division and Incorporation

The literature review in Section I of the article gives us a number of hypotheses to structure the analysis of the decision to divide the commons. This literature does not consider the problem of incorporation since membership rights in communities are usually acquired by birth and consequently are not an endogenous choice. Membership determined by democratic vote is specific to property rights in the *ejido* and to rules under the PROCEDE program. For that decision, hypotheses consequently need to derive from the historical specificity of the *ejido* and from the case studies.

A. Decision to Divide

The literature on the decision to divide gives us three analytical categories: Boserup and the rising costs of externalities, the opportunity cost of dividing, and the risks and cost associated with division.

Boserup: Scarcity and value. Following this approach, two categories of variables that induce division of CPR in individual tenures are:

i) Land scarcity: This is reflected by the amount of communal land available per member.

ii) Value of the resource: This is reflected by the yield potential of the land that can be converted in individual tenures and by the degree of market integration.

Opportunity cost of division: Quality of cooperation. Different communities have vastly different abilities to cooperate and collectively manage their CPRs. When the quality of governance is high, CPRs are better managed and CPR land is more profitable, increasing the opportunity cost of dividing the land. Hence, *ejidos* with greater ability to cooperate are more inclined to refrain from dividing the commons in individual tenures.[16]

Risks and costs of division. If the current distribution of economic benefits from use of the commons is highly unequal, dividing the commons may be seen as a way of redistributing opportunities toward greater equality. This would be the case when livestock ownership is highly unequally distributed across community members and when median voters in assemblies consequently feel cheated in how CPRs are used. By contrast, as pointed out by Baland and Platteau, high inequality in economic power may signal risks in agreeing on distribution resulting in unequal benefits, blocking the possibility of moving forward with distribution of the commons.[17] High inequality in current use (livestock ownership) would consequently create incentives for division, while high inequality in economic power (individual landownership) would deter division. Larger communities may also have higher costs of decision making in changing property rights and, thus, reduce division.[18]

B. Decision to Incorporate

This decision is specific to the nature of property rights in the Mexican *ejido* and to the restrictive rules of incorporation that prevailed before the reforms.

Population pressure on those with rights. The principal determinant in deciding to incorporate new members is the population pressure on those currently with rights of access. This pressure originates from the sons and daughters of *ejidatarios* and from migrants to the community who could not be incorporated under the restrictive rules of admission that prevailed before the 1992 reforms. Clearly, the special affective relation between members and nonmembers is a strong determinant of incorporation, in spite of the negative externalities they may impose on current members.[19] This pressure is represented by the number of households in the community that do not have *ejidatario* rights relative to the number of *ejidatarios*.

Abundance of common land. New members must receive an individual parcel of land and access to their share of the remaining land in CPR. The area of common land per member before incorporation is thus an indicator of the ease of incorporating new members. In particular, greater abundance of common land results in a lower negative externality on current users created by one additional member.

Abundance of private land. New members can also be incorporated by gaining access to part of the land held by a current member, either through sale or gift, and then asking the assembly to be accepted as full members. The larger the land parcels held by current members, the more likely this form of incorporation will occur. When the sale is ratified by the assembly, the new members acquire *ejidatario* status and also gain access to their shares

of CPR land. If the assembly chooses not to accept them as *ejidatarios*, they can keep the land as *posesionarios*, but they cannot vote in assembly meetings and have no rights over the commons.

C. Legal Opportunity to Divide and Incorporate

The opportunities to divide and to incorporate were given by the PROCEDE program. By 1997, 62% of the communities were in progress or had completed certification of land rights to *ejidatarios*, and 87% had held a first meeting with PROCEDE officials. In all cases, however, given that PROCEDE began in 1994, *ejidos* were informed of the incoming reforms and could take autonomous initiatives in dividing the commons, to be later ratified by PROCEDE. In some cases, conflicts over the *ejido's* external boundaries implied delays in dividing the commons, as allocated lands could subsequently be challenged by outsiders.

D. Implications for Poverty and Inequality

Initial allocation of individual parcels was egalitarian among members of the *ejido*. After this, however, decades of internal exercise of influence in encroaching on the commons and informal land transactions resulted in inequalities. Certification of land parcels and opportunities to divide and incorporate under PROCEDE could be used to amplify, ratify, or compensate for inequalities. Under the traditional view that market forces are inequalizing while government (in this case, the *ejido* assembly) interventions can be equalizing, certification under the transparent and democratic approach imposed by PROCEDE rules and procedures could be both poverty reducing (access to land for the poor) and equalizing (access to more land for those with smaller endowments).

We use these categories to organize the analysis of the decisions to divide and incorporate, both in the case studies and with the *ejido*-level survey data. Because the two decisions are related, a reduced form analysis of these two decisions will, in the end, rely on the hypotheses advanced for both decisions.

III. Case Studies of Responses to PROCEDE

There is richness in information from case studies that cannot be equaled by the information contained in survey data. This richness of details does not, of course, aggregate into global patterns. Survey data are needed for this purpose. Consequently, we proceed sequentially in using these two levels of information: case studies to extract insights about processes and survey data to confirm the significance of these processes.[20]

Twelve case studies were conducted between 1997 and 1999 in *ejidos* located in the states of Yucatan, Tabasco, Campeche, San Luis Potosí, and Zacatecas. From the wealth of information provided by the case studies, we only report here information that (1) helps us set up hypotheses for the empirical analyses of the decisions to divide, incorporate, and equalize and (2) provides us with interpretations of motivations and causalities involved. The

ejidos selected all went through the PROCEDE program. Table 1 gives a summary of the results.

A. Boserup: Scarcity and Value

Land scarcity in communal ejidos. Case studies show that the logic of dividing and incorporating takes on special aspects in communal *ejidos*. In these *ejidos*, 100% of the land was in common property. In the three communal *ejidos* analyzed, common property land was used by community members for subsistence shifting cultivation. The cooperation mechanisms embedded in local traditions have regulated land use and maintained high soil fertility for as long as land was abundant enough to keep long rotation cycles. This is still the situation in Yaxcabá and San Pedro Yaxcabá where land is abundant. In these communal *ejidos*, the tradition is that all children of *ejidatario* households are incorporated as members as soon as they become adults—that is, as long as there is unused land. According to the *ejidatarios* in El Edén, competition for the best land plots had shortened the fallow periods, increasing the expectation of gains from switching to an individual property rights system. Rising land scarcity thus led members of that *ejido* to vote for division of the commons.

Value of the resource. The quality of common property land—and its consequent potential for agricultural use—is important in inducing partial or total division. In Corregidora, the land most suitable for growing corn or for establishing cocoa and palm plantations was titled individually. In Plan de Ayala and La Manga, division was prompted by the profitability of introducing high-yielding forage varieties on good-quality lands and enclosing the fields. The argument made by *ejidatarios* was that they wanted to have more control over these investments and thus preferred to make them individually. The partial privatization of El Huizache, El Chilar, and Socorro de Dios also supports this idea, because it was only the best lands that were divided, while the rest was maintained as common property. In San Pedro Yaxcabá, even when division was voted down, the main interest in the assembly debates was on division of the few high-quality areas.

B. Pressure and Possibility to Incorporate New Members

Population pressure on those with rights. In table 1, population pressure refers to the number of non-*ejidatario* households living in the *ejido* village relative to the number of *ejidatarios*. In the case of Corregidora, members could respond to population pressure by endowing land to the whole younger generation of households because the commons were very extensive. This was done as a one-time deal under the agreement that any future endowments would have to come from the parents themselves. La Manga, on the other hand, despite high population pressure, decided not to add new *ejidatarios* and divided the commons only among the older generation. In Socorro de Dios there is no population pressure because the young are long-term migrants. Nevertheless, the commons were divided and allocated in their names. The

TABLE 1

SUMMARY OF *EJIDO* CASE STUDIES

			EXPLANATORY VARIABLES PRE-PROCEDE						
	DECISIONS		CPR Land Scarcity	Private Land Scarcity	Value of the Resource	Population Pressure on Members	Opportunity Cost of Division	Risks and Costs of Division	
Ejido AND STATE	Division of the Commons	Incorporation of New Members	Common Property Endowments (ha/Member)	Individual Land Endowments (ha/Member)	Land Quality in the Commons	Non-*ejidatarios* per *Ejidatario*	Cooperation in the Commons	Land Inequality	Herd Inequality
El Edén, Yucatán	Divided	Incorporated	9.1 Communal	0	High	High	Tradition based, growing conflicts	Low	N.A.
San Pedro Y., Yucatán	Not divided	No change	25.1 Communal	0	Low, on average	Low	Tradition based, few conflicts	Low	N.A.
Yaxcabá, Yucatán	Not divided	Incorporated	31 Communal	0	Low, on average	Low	Tradition based, no conflicts	Low	Low
Plan de Ayala, Campeche	Divided	Incorporated	37.7	32	High	Low	Failure	Low	Low
Socorro de Dios, San Luis Potosí	High-quality land divided	Incorporated	47.6	20	High and low quality	Low	Failure	High	High
Corregidora, Tabasco	Partially divided	Incorporated	93.7	13	High	High	Failure (palm) & success (timber)	Low	Low
La Manga, Tabasco	Partially divided	No change	9.5	10	High	High	Failure	High	High
El Chilar, Campeche	High-quality land divided	No change	47.6	17	High or low quality	Low	Failure	Low	High
Huizache, San Luis Potosí	Irrigated land divided	Under discussion	29.1	20	High or low quality	Low	Mixed results	Low	High
Mala Noche, Zacatecas	Division into subcoalitions	No change	21.9	15	Good, but located far from village	Low	Failure	N.A.	Low
Efigenia, Zacatecas	Division into subcoalitions	Incorporated	30.4	25	Low	Low	Failure	Low	High
Pozo Hondo, Zacatecas	Division into subcoalitions	No change	27.0	15	Low	Low	Failure	Low	High
Expected sign for division of the commons			− Communal, + Others	?	+	+	−	−	+
Expected sign for incorporation of new members			+ Others	+	?	+	+	?	?

parents expected either that this would give their children reason to resettle permanently in the *ejido* or that they would become stewards of their children's lands, building up the cattle herds funded with their remittances. Thus, while population pressure induces incorporation and division, we also see refusal to incorporate in spite of pressure and incorporation without pressure.

Land abundance and incorporation. The amount of individual property land held by *ejidatarios* favors the incorporation of new members for two reasons: (1) facing restrictions on how many of their children they can bequeath land to, *ejidatarios* can use the legal loophole of requesting their incorporation as new *ejidatarios* with the sale by selling them part of their individual landholdings at a zero price; (2) for outsiders wanting to purchase *ejido* land, it is easier to be incorporated as new *ejidatarios* and to use the less-restrictive intra-*ejido* trading regulations than to undergo the long, costly, and uncertain process of taking the land out of the *ejido* system before purchasing it. In the case of Corregidora, there were examples of the first procedure in incorporating members, while Plan de Ayala had cases of the second. Individual-to-individual trades have thus occurred through incorporation, which the assemblies preferred because it would "strengthen the *ejido*" instead of weakening its internal links and collective functions. These trades are favored by abundance of land in individual parcels.

C. Risks and Costs of Division: The Role of Inequality

Cases where regulation of use of common grazing lands was attempted always addressed the two problems of overgrazing and unequal use of the commons. The purpose of the proposed regulations was to solve simultaneously these two interconnected issues. By fixing the total number of animals that could be introduced in the commons, overgrazing was reduced and, thus, each member received an equal quota. Those with fewer animals could then trade their quotas with those with an excess of animals. With no limits, everyone had the right to put as many animals as desired in the commons, and there was no reason for those who grazed more animals to compensate those who had fewer.

In none of the cases studied was regulation entirely successful. In Efigenia, regulation was voted down, while, in the cases of Socorro de Dios and Pozo Hondo, it was approved only to be abandoned at the implementation stage. With cooperation failure, we observe that division appears as the main alternative for those making little use of the commons. High inequality in livestock ownership thus induces the median voter to prefer division.

One of the reasons *ejidatarios* gave for the failure to regulate cattle grazing was weak enforcement due to traditional reliance on voluntary compliance. Either the regulations did not include sanctions, or the *ejidatarios* did not ever expect them to be enforced. With inability to regulate, some *ejidos* responded by changing the size and composition of the decision group, effectively dividing the commons among subcoalitions of members. This strategy was used both before the reforms and when legal division was effectively

blocked by a majority vote in the post-PROCEDE environment. In these cases, the objective of the assembly was to create a situation more conducive to cooperation. This is why in Plan de Ayala and Mala Noche, the common property land was divided into sections managed by subgroups. In Plan de Ayala, the process of forming subcoalitions following cooperation failure continued until land was completely divided, first into extended family units and finally into individual household units. In Mala Noche, subcoalitions persisted despite the possibility of individual division. People interviewed mentioned that the large distance between the *ejidatario* dwellings and the commons made enforcement of individual rights too costly. A different reason for subcoalition formation in a postreform environment occurred in Pozo Hondo and Efigenia. There, the parties in favor of division proposed divisions among subcoalitions as the second-best solution when their assemblies rejected full individual privatization of the commons.

D. Equalizing Division

Because of informal transactions and unequal encroachment, there are differences in land assets among members of the same *ejido* even if initial endowments were egalitarian. In the case of La Manga, division of the commons was used to compensate for the existing differences in individual endowments and to give every member the same amount of land. The same happened in Socorro de Dios, where the minority had control over the best-quality land in the commons and, claiming it as their own, desperately tried to obtain individual titles to it, blocking for months attempts by the majority to proceed with a formal and egalitarian division of the commons. In Corregidora and El Edén, the allocation combined assigning the plots that had been occupied informally with a complement in order to make them add up to equal shares.

The division process entails difficulties in determining the quality of the land each particular *ejidatarios* will receive. When opting for individual titling, the *ejido* must solve the problem of land allocation among its members, which is especially difficult when land quality is heterogeneous and difficult to predict. The solution observed in La Manga, Socorro de Dios, and El Edén was to use a lottery system. Most of their commons had not been encroached previously and were relatively homogeneous, so a lottery system was perceived as a fair way of allocating land of unknown quality. Where land has heterogeneous quality that was hard to predict, allocation problems discouraged division, which is what occurred in San Pedro Yaxcabá.

IV. Econometric Analysis of the Decisions to Divide and Incorporate

A. The Survey Data

The panel data for the econometric analysis cover 288 *ejidos* and 1,068 *ejidatarios*. These communities and households were interviewed first in 1994, before the titling program began, and then again in 1997. The *ejidos* and the

households within these *ejidos* were randomly chosen nationwide in 1994. Only the state of Chiapas was excluded from the analysis because of warfare during the time of the 1994 survey. The number of households surveyed per *ejido* is not sufficient to make inferences from them about the rest of the members, so the *ejido*-level analysis uses only information from the corresponding survey.

B. Importance of Common Property Resources in the Ejido

Not all *ejidos* are endowed with commons. In the survey, 181 (63%) of the 288 *ejidos* have CPR. Historically, some *ejidos* received all their land as commons, while others had a mix of individual and common tenure and still others had no CPR. This was based on the inclination of the group that had asked for land, on the ideology of the government under which the distribution took place, on the physical characteristics of the land, and on the number of people that would form the *ejido*. The stated objective of the redistribution was to give enough land to peasants so the household could be self-sufficient in food production. In 1994, after more than 7 decades of creating *ejidos*, the percentage of land held in common differed across *ejidos* of different sizes, as can be observed in figure 1. Among *ejidos* with CPR, 12.2% have less than 10% of their land in common while 29.8% have more than 90% of their land in common, with a mean value of 62%. As figure 2 shows, the share of the land in CPR increases when there is more land abundance: this share rises from 47.1% in *ejidos* with less than 25 hectares of land per member to 90.3% in *ejidos* with more than 150 hectares per member.

Of the 181 *ejidos* with commons in the survey, 70 did not divide or incorporate new members in the 1994–97 period, while 35 divided without incorporating, 47 incorporated without dividing, and 29 both divided and incorporated.

C. Ejido-*Level Analysis*

The two decisions to divide and to incorporate are clearly interrelated as division of the commons is often for the purpose of incorporating new members. In other cases, division may be induced by factors such as land scarcity or rising value of the land and will be pursued to increase efficiency without incorporation. We thus tested a bivariate probit model but could not reject orthogonality of the error terms.[21] This shows that the two decisions are related by the exogenous variables used, not by unobservables. We consequently report in table 2 results for two separate probits. Table 2 gives the marginal effects of each exogenous variable on each decision. We also calculate in the last three columns the marginal effects of each variable on the decisions to divide with or without incorporating, and on the decision to incorporate without dividing. These are calculated as follows:

Let the probability of division (D) be $\Pr(D = 1) = \Phi(\beta' X)$ and the probability of incorporation (I) be $\Pr(I = 1) = \Phi(\gamma' X)$, where Φ is the cu-

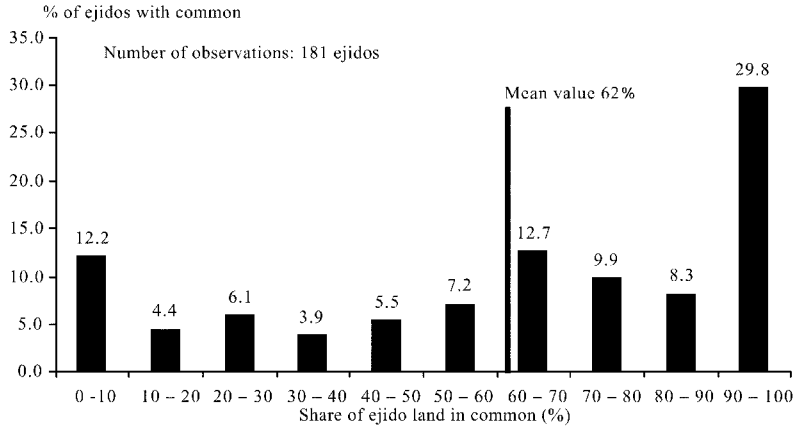


FIG. 1.—Distribution of common property land

mulative normal and X the vector of explanatory variables with coefficients β in division and γ in incorporation. Since the two probits are independent, we can calculate joint probabilities as follows:

Probability of division without incorporation: $\Pr(D = 1, I = 0) = \Phi(\beta' X)(1 - \Phi(\gamma' X))$.

Probability of division with incorporation: $\Pr(D = 1, I = 1) = \Phi(\beta' X)\Phi(\gamma' X)$.

Probability of incorporation without division: $\Pr(D = 0, I = 1) = (1 - \Phi(\beta' X))\Phi(\gamma' X)$.

Note that the marginal effect of any variable X on the probability to divide can be additively decomposed into its effect on the probability to divide without incorporation and the probability to divide with incorporation:

$$\frac{d\Pr(D = 1)}{dX} = \frac{d\Pr(D = 1, I = 0)}{dX} + \frac{d\Pr(D = 1, I = 1)}{dX}$$

A similar decomposition can be written for the probability to incorporate.

Even though they are measured in 1994, the variables that characterize cooperation can be suspected of endogeneity in the decisions to divide and incorporate. We perform a test of statistical exogeneity following the method proposed by R. Smith and R. Blundell.[22] The instruments are whether the CPR provides sources of revenues for the *ejido* and the age of the *ejido*. These are valid instruments, as they are significant in the equations that explain cooperation but not in the equations that explain division and incorporation. Similarly, we do a test of statistical exogeneity of the decision to initiate PROCEDE during the 1994–97 period.[23] Instruments are the geographical regions, which again prove to be valid instruments. In all three cases, statistical exogeneity cannot be rejected.

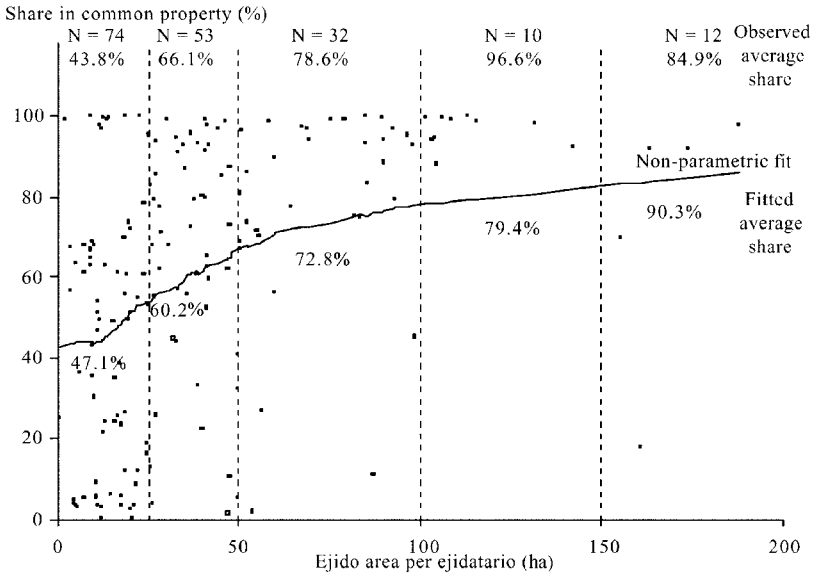


FIG. 2.—Share in common by *ejido* per capita size

Results are presented with the same categories of variables used in the formulation of hypotheses and the case studies.

D. Boserup: Scarcity and Value

Land scarcity in communal ejidos. Communal *ejidos* where shifting agriculture is practiced on CPR land characterize the type of situation analyzed by Boserup.[24] We find that these *ejidos* have a 50% higher chance of dividing the commons and a 39% higher chance of incorporating new members than noncommunal *ejidos*. As shown by the decomposition in the last three columns of table 2, these marginal effects result from a decision to jointly divide and incorporate, the probability of which increases by 52%. When land scarcity is higher, the probability of division increases by 6.9% for the loss of each hectare, and the main motivation behind division is not incorporation as 60% of the effect comes from the decision to divide without incorporation. Hence, as predicted by Boserup, division would be pursued for efficiency purposes, namely, to reduce the negative externalities associated with CPR. When land endowments per member are low, as was the case of El Edén, division is perceived as a necessity in spite of the deep cultural changes that this implies for the community.

Value of the resource. The value of the resource is also a Boserupian determinant of the decision to divide. We use the lowest yield on parcels individually cultivated in corn as an indicator of the marginal value of common land. Historically, mixed tenure *ejidos* were formed with individual parcels

TABLE 2

DIVISION OF COMMON PROPERTY LAND AND INCORPORATION OF NEW *EJIDATARIOS*, 1994–97

EXOGENOUS VARIABLES (1994)	MEAN	DIVISION OF COMMONS (0/1)		INCORPORATION OF NEW MEMBERS (0/1)		DIVISION WITHOUT INCORPORATION	DIVISION WITH INCORPORATION
		d*F*/d*x* (%)*	*P* Value†	d*F*/d*x* (%)*	*P* Value†	d*F*/d*x* (%)*	d*F*/d*x* (%)*
I. Boserup, scarcity and value:							
Land abundance in communal *ejido* only:							
Ejido is communal (0, 1)	.17	50.2	.10	39.4	.00	−.9	51.2
Common land per member when *ejido* is communal (ha)	17.1	−6.9	.06	−.01	.92	−4.1	−2.8
Value of the resource:							
Marginal agricultural yield (tons of corn/ha)	.6	15.0	.01	3.5	.41	7.7	7.3
Distance to nearest urban center (km)	26.9	−.01	.94	.08	.29	−.03	.02
II. Pressure and possibility to incorporate:							
Population pressure on those with rights:							
Non-*ejidatario* households per *ejidatario*	1.2	.22	.04	2.66	.06	−.79	1.01
Land abundance in noncommunal *ejido*:							
Common land per member (ha)	29.1	.11	.07	.16	.00	.01	.10
Average individual land per *ejidatario* (ha)	10.2	.19	.40	.86	.01	−.18	.38
III. Opportunity cost of division and incorporation, quality of cooperation:							
Ejidos had formal rules for CPR use (0, 1)‡	.19	−17.6	.06	−17.7	.01	−6.7	−10.9
Number of meetings held per year‡	7.8	−1.5	.01	−1.0	.22	−.5	−1.0

IV. Risks and costs of division: inequality and size of the group:							
Individual land inequality ratio (largest/smallest parcel)	6.5	−1.9	.05	1.7	.07	−1.7	−.2
Individual land inequality ratio, squared	170.3	.03	.03	−.02	.10	.03	.01
Inequality in grazing in commons (largest/smallest herd)	3.0	.44	.00	.19	.79	.20	.24
Number of *ejidatarios*	91	.04	.41	.06	.34	.00	.04
V. Legal opportunity to divide and incorporate							
First meeting of PROCEDE held	.89	4.9	.76	−7.0	.36	5.1	−.1
PROCEDE started certification in 1994–97‡	.68	−6.8	.41	16.9	.31	−10.4	3.6
Conflicts over the commons' external boundaries	.08	−27.0	.01	12.7	.24	−17.1	−9.9
Mean value of endogenous variable		.35		.42		.20	.15
Number of observations	168	168		168			
Pseudo-R^2		.22		.14			
Correctly predicted outcomes		71%		70%			
Overall *F*-test of equation			.01		.02		

* Marginal effect on probability is average of the marginal effects over the population. Marginal effect for dummy variables is computed as difference in probability for the dummy equal to 1 and to 0.

† *P* value is for the underlying coefficient in probit.

‡ Smith-Blundell test cannot reject statistical exogeneity.

located in the best lands for agriculture, leaving the rest in commons. It is, therefore, expected that any expansion of agriculture over the commons would generate the low end of the observed yields in parcels. The estimated coefficient for the effect of land quality on division is positive, supporting the hypothesis that individual property rights emerge where land is more valuable, and this effect comes equally from cases of division with and without incorporation.

Boserup also calls upon the argument of market integration in explaining why the value of the resource changes, leading to eventual individualization. We used for this reason distance to the nearest urban center as an indicator of market integration. However, it is not significant.

E. Pressure and Possibility to Incorporate

Population pressure on those with rights. Pressure on *ejidatarios* to incorporate new members is proportional to the number of non-*ejidatarios* in the community relative to the number of *ejidatarios*. On average, this pressure is high, with 1.2 non-*ejidatario* households for every *ejidatario* household. A 10% increase in non-*ejidatario* pressure increases the probability of incorporating by 26.6% and of dividing by 2.2%. The decomposition of marginal effects shows that the main motivation is incorporation and that it comes both with and without division of the commons (10% and 16.6%, respectively). This pressure to divide for incorporation is, however, compensated by a strong reduction in the temptation to divide among those that decide not to incorporate (−7.9%). This finding supports the hypothesis suggested by the case studies, where the *ejidos*' assemblies accept non-*ejidatario* households belonging to the community as members, endowing them with land from the commons. Note that this population pressure is not a Boserupian land scarcity argument. It is an institutional problem embedded in the constitution of the *ejido* that was designed to minimize incorporation of new members to avoid division of the land over larger and larger numbers of members. Elimination of these restrictions, and the legal possibilities of dividing and incorporating, was thus the cause of the changes observed where population pressure was high.

Land abundance in noncommunal ejidos. Results show that the larger the CPR endowment per member, the higher the probability that some of it will be divided into individual plots. Similarly, higher CPR endowments per member allow greater incidence of incorporation of new members. We see, however, that there is no division without incorporation and that division is in response to the desire to accommodate new members. This effect is thus different from the situation considered by Boserup: it is not greater land scarcity that induces division but greater abundance that offers opportunities to incorporate new members (principally the sons and daughters of *ejidatarios*), and some of the CPR land is divided to provide individual land endowments to these new members.[25]

Individual land endowment per *ejidatario* is not important for the decision

to divide, but it is important for the decision to incorporate new members, which may happen either with or without division of the commons. As we have seen in the case studies, incorporation of new members is in part done by dividing individually held parcels. The larger these are, the more it is possible to follow this strategy to incorporate the sons and daughters of *ejidatarios*.

F. Opportunity Cost of Division and Incorporation: Quality of Cooperation

The opportunity cost of dividing the land depends on the quality of management of the CPR as determined by the level of cooperation in the community. The two indicators of cooperation available in the survey are (1) the presence of regulations that reduce the negative externalities present in common property, which in the case of forested *ejidos* means a forestry organization and, for rangeland *ejidos*, involves regulation on the number of animals and (2) the frequency of assembly meetings held in the past 12 months, which acts as an indicator of the quality of cooperation, where a higher frequency of meetings points to greater possibilities of enforcing and adjusting the existing coordination mechanisms. Table 2 shows that estimated coefficients for the two cooperation indicators are negative. This result supports the hypothesis that better cooperation under a common property regime reduces incentives to divide the commons (N. McCarthy, A. de Janvry, and E. Sadoulet found a similar disincentive for individuals to encroach on the commons when cooperation is higher).[26]

Cooperation (*ejido* with formal rules) also deters incorporation of new members. Since cooperation allows better management of CPR, it is land saving and should thus have favored incorporation in the same way as more common land per member favors incorporation. However, cooperation is harder to maintain the larger the size of the group.[27] As a consequence, when cooperation is strong, the group may be wary of incorporating new members that would make sustaining this level of cooperation more difficult.

G. Risks and Costs of Division: Inequality and Size of the Group

The literature review suggested that risks in the process of division affect the decision to privatize. We use inequality in land parcels owned (ratio of largest to smallest parcel) to measure the relative economic power of *ejidatarios* and, hence, their unequal abilities to influence the decision to divide. Econometric results confirm the suggestion made by Baland and Platteau that inequality deters division (up to a maximum inequality of 27.5, when average observed inequality is 6.5).[28] Conditional probabilities show that the division, which is deterred by higher inequality, is not being pursued for the purpose of incorporation. Inequality in the size of herds of livestock grazing in the commons (ratio of largest to smallest herd) has the opposite effect: higher inequality induces division, with no impact on incorporation, confirming what we saw

in case studies. The costs in deciding to divide or incorporate can be expected to rise with the number of members in an *ejido*. However, this variable is not significant, neither on division nor on incorporation.

H. Legal Opportunity to Divide and Incorporate

The unique feature of the period over which we have panel data is the sudden opportunity given to *ejidos* by the PROCEDE program in privatizing CPR and incorporating new members in the *ejido*. Econometric results show, however, that neither the holding of an initial meeting nor initialization of the certification process makes any difference on division and incorporation. This does not mean that PROCEDE was inconsequential, since 61% of the *ejidos* with CPR divided or incorporated new members during the 1994–97 period. What it means is that all the communities that wanted to implement these changes had already started the process on their own based on information that these changes were now legal and were to be ratified by PROCEDE once they reached the *ejido*. The certification program was thus massively effective during the period, but it cannot be distinguished from other changes that occurred in the intervening years. However, neither division nor incorporation could have happened at that scale during this period without the discounted effects of the program.

Conflicts regarding the external limits of the commons reduce the likelihood of division. Historical disputes and limited political commitment from the federal government to solve these conflicts had nearly 8% of the *ejidos* with commons under a status of uncertainty about their external limits in 1994. If division were carried out, individuals receiving disputed land would risk losing it. By keeping the commons as such, the ownership claim would still have the interest and backing of all *ejidatarios*. In addition, PROCEDE had the policy of not giving out individual titles in areas that were under legal challenge, so any informal division would have even less value.

I. Relative Importance of Theoretical Determinants of Division and Incorporation

We have used five categories of determinants in explaining the decisions to divide and incorporate: Boserup scarcity and value, pressure and possibility to incorporate, opportunity cost of division and incorporation, risks and costs of division, and legal opportunity to divide and incorporate. To measure the relative importance of these five categories of variables, we reestimate the equations in table 2 as linear probabilities. Each category i of variables is a $(\hat{\beta}'X)_i$. We can then decompose the total explained variance, $\mathrm{Var}[\sum_{i=1}(\hat{\beta}'X)_i]$, as:

$$\mathrm{Var}\left[\sum_{i=1}^{5}(\hat{\beta}'X)_i\right] = \sum_{i=1}^{5}\mathrm{Var}(\hat{\beta}'X)_i + \sum_{i=1}^{5}\sum_{j=1,j\neq i}^{5}\mathrm{Cov}[(\hat{\beta}'X)_i,(\hat{\beta}'X)_j].$$

We measure the share of the total variance that each category explains as a direct effect equal to $\mathrm{Var}(\hat{\beta}'X)_i$ and an indirect effect equal to $\sum_{j\neq i}^{5}\mathrm{Cov}[(\hat{\beta}'X)_i,(\hat{\beta}'X)_j]$. This is more acceptable given that indirect effects are small here relative to direct effects. Results in table 3 show that the Boserup effect accounts for 40% of explanatory factors in the decision to divide and provides the most powerful explanatory category. Land scarcity in communal *ejidos* and value of the resource play equal roles. The role of cooperation in managing the commons is the next most important explanatory factor, accounting for 27% of the explained variance. This is followed by the pressure and possibility to divide in order to incorporate (17%) and, finally, the risks and costs of division (8%). The Boserup theory was, of course, not developed to explain incorporation. For this, the most important factor is the pressure and possibility to incorporate, accounting for 39% of explained variance. Of nearly equal importance are the Boserup effects (22%, mainly land scarcity), the opportunity cost of division (18%), and the risks and costs of division (16%).

Confirming the results obtained by Otsuka and Place in other countries, this decomposition shows the importance of Boserupian scarcity and value effects for the Mexican *ejido*.[29] However, it also stresses the importance of looking beyond these effects in explaining the division of CPRs. Of great importance from a policy standpoint is the role of cooperation in giving communities an alternative to division if there are better options. Indeed, if there are economic and environmental gains from keeping the CPR as a unit

TABLE 3

Decomposition of Explanatory Factors of the Decisions to Divide and Incorporate

	Decision to Divide (% of Total Variance Explained)			Decision to Incorporate (% of Total Variance Explained)		
Explanatory Factors	Direct Effect	Indirect Effect	Total Effect	Direct Effect	Indirect Effect	Total Effect
Boserup, scarcity and value:						
Land abundance in communal *ejido* (population pressure on land)	21	3		50	−32	
Value of the resource	21	−6		2	1	
Total effect	42	−3	40	53	−31	22
Pressure and possibility to incorporate:						
Population pressure on those with rights	1	−1		11	−3	
Land abundance in noncommunal *ejido*	18	−1		52	−21	
Total effect	18	−2	17	63	−24	39
Opportunity cost of division and incorporation: quality of cooperation	27	0	27	22	−3	18
Risks and costs of division: inequality and size of group	22	−14	8	23	−7	16
Legal opportunity to divide and incorporate	17	−8	8	14	−10	4
Total effect	127	−27	100	174	−74	100

of management, this result has meaningful policy implications in showing the importance of assisting communities to improve their abilities to govern when control over resources is devolved to them.[30]

J. Incorporation in Ejidos without Commons

Ejidos with no commons have also responded to PROCEDE by incorporating new members. The presumption, however, is that the decision model for these *ejidos* is quite different from that of *ejidos* with CPRs, in particular as many variables pertaining to the common resources cannot enter the model. From an independent estimation on the 37 *ejidos* without commons for which we have complete data, the significant factors in inducing incorporation are PROCEDE (which increases the probability of incorporation by 45 percentage points), inequality in private land (marginal effect of 4.2 percentage points), population pressure from non-*ejidatarios* (6 percentage points), and the total number of *ejidatarios* (.13 percentage points).

To test for this hypothesis, we estimated the decision to incorporate for all *ejidos* and found that there is no difference in parameters between those with and without CPR, except for two: the intercept and average individual land per *ejidatario*. *Ejidos* without commons have a 30% higher probability to incorporate, and the marginal effect on individual land per *ejidatario* is an increase in the probability of incorporation by 1.8% per additional hectare, compared to .86% for *ejidos* with commons. This last result is quite intuitive, as incorporation of new members when the *ejido* does not have any commons relies on the possibility of sharing individual plots. *Ejidos* without CPR thus also responded to PROCEDE by incorporating new members, and the number of new members brought in was larger where current members had more individual land that they could share.

V. Household-Level Analysis

The household panel shows a large number of *ejidatarios* (53%) reporting a gain in individual control over land between 1994 and 1997, with an average of 2.6 additional hectares (table 4). Before the reforms, appropriation of the commons only took place informally. Encroachment through exercise of influence has been a prevalent practice in *ejidos* with commons suitable for agriculture. Access to land can still increase in this fashion in *ejidos* with commons and no formal division. With the reforms, land assets can be increased through division of the commons if the assembly approves it. In addition, an *ejidatario* can now purchase individual *ejido* parcels from fellow members, in addition to buying private land outside the *ejido*, which always was an option. Hence, access to land can also increase even where there are no commons.

The surveys show noticeable differences in land asset changes between *ejidatarios* living in *ejidos* with commons and those without, and whether or not *ejidos* with commons engaged in division and incorporation during the period. The data in table 4 show that net increases in land assets at the

TABLE 4

CHANGES IN HOUSEHOLDS' INDIVIDUAL CONTROL OVER ASSETS BETWEEN 1994 AND 1997 BY TYPE OF *EJIDO*

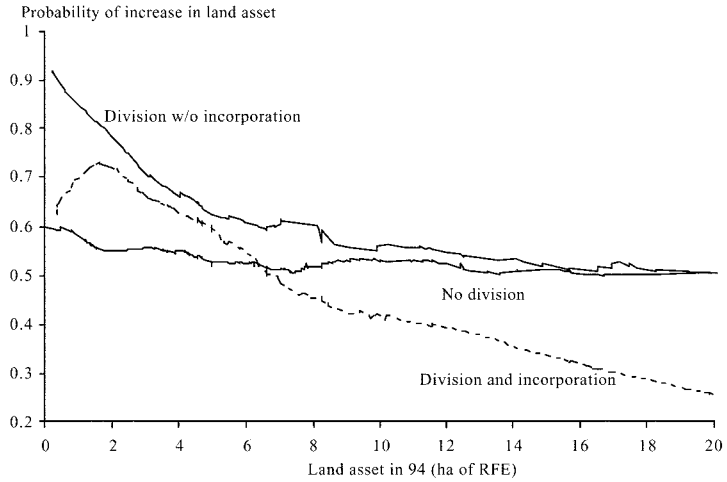
			Ejidos WITH COMMONS			
	ALL *Ejidos*	*Ejidos* WITH NO COMMONS	All	No Division	Division with Incorporation	Division without Incorporation
Number of households	1,084	189	895	559	146	190
Households whose land assets increased (%)	53	43	55	53	53	63
Increase in land assets (rain-fed equivalent ha)	2.6	1.0	2.9	2.7	3.5	2.8

household level were more frequent in *ejidos* with commons (55%) than in *ejidos* without (43%) and that the gains in land were larger in the first case (2.9 hectares) than in the second (1 hectare). Among *ejidos* with commons, the frequency of gains was highest when there was division without incorporation (63%).

To complement descriptive statistics, we present in figure 3 nonparametric fits of the relation between probability of additional access to land and initial land assets held in 1994 (measured in rain-fed equivalent hectares) separately for households in *ejidos* that did not divide, divided and incorporated, and divided without incorporation. They show the progressive nature of gains in land in *ejidos* where there was division, especially division without incorporation, with those with less land more likely to gain more. In figure 4, the percentage gain in land assets is fitted against initial land endowments. They also show the progressive nature of gains in access to land, particularly when there was division. Gains in land were largest when there was division without incorporation.

The impact of PROCEDE on land inequality differed across *ejidos* depending on their decisions to divide and incorporate. We characterize this using the Gini coefficient for the size of individual plots in the panel of households in 1994 and in 1997. In *ejidos* where there was no incorporation and no division, the Gini remained constant, equal to .54 in 1994 and to .53 in 1997. In *ejidos* where there was incorporation without division, plots of land were divided by some to accommodate new entrants, increasing inequality from .52 in 1994 to .56 in 1997. By contrast, when there was division without incorporation, division was used to equalize access to land. In these *ejidos*, the Gini coefficient fell from .55 in 1994 to .51 in 1997.[31]

In analyzing changes in individual access to land, we want to contrast the role of market forces and unregulated exercise of influence (encroachment) with the role of governance codified by PROCEDE in reallocating assets (division). The presumption is that market forces and exercise of influence can increase inequality and be discriminatory (*ejidos* that did not divide),



Average value of probability of increase in land asset

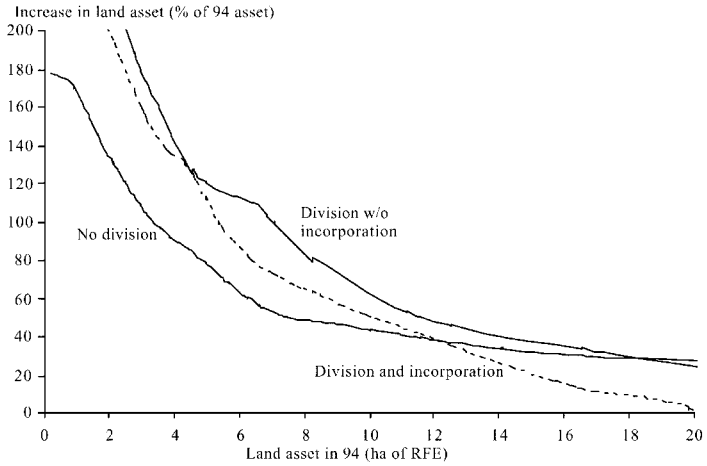
Land in 94 (ha)	0 – 2	2 – 4	4 – 6	6 – 8	8 – 10	10 – 12	12 – 14	14 – 16	16 – 18	≥ 18 ha
No division	0.57	0.55	0.53	0.52	0.53	0.53	0.51	0.51	0.50	0.50
Div. w/o incorp.	0.84	0.72	0.64	0.60	0.57	0.56	0.54	0.52	0.52	0.41
Div. with incorp.	0.70	0.67	0.60	0.49	0.43	0.40	0.38	0.33	0.31	0.28

FIG. 3.—Probability of land asset increase by initial endowment

while democratic governance can play an antipoverty and redistributive role (*ejidos* that divided). To do this, we analyze separately the *ejidos* where there was no division of the commons (and, hence, where changes in access to land were the product of market and influence forces) and the *ejidos* where there was division of the commons (and, hence, where changes in access to land were the outcome of democratic interventions in addition to market forces).

Changes in a household's land assets are thus expected to depend on household characteristics (the natural, human, and physical capital assets it had in 1994 and its demographic and ethnic status); *ejido* characteristics (abundance of common and individual land, quality of cooperation in the management of CPR, degree of market integration); and the decisions taken by the *ejido* about the commons (division) and the membership (incorporation).[32]

Table 5 presents the econometric analysis of the changes in land assets held by individual households. For the qualitative analysis of changes in land assets, we use both a probit analysis (increase in assets or not) and an ordered probit (decrease, no change, increase in assets). Because individual observations are bunched in different *ejidos*, we use a correction for heteroscedasticity due to the clustering of errors. For the probit, results with a clustering of errors are similar to a random effects probit (not reported). For the quantitative analysis of hectares gained or lost, we use regressions with random or fixed *ejido* effects, reporting the results from fixed effects regression when random effects are rejected. Adding treatment for clustering of errors does not change results when random or fixed effects are used (not reported). We



Average value of percentage increase in land asset

Land in 94 (ha)	0 – 2	2 – 4	4 – 6	6 – 8	8 – 10	10 – 12	12 – 14	14 – 16	16 – 18	≥18 ha
No division	156.8	109.3	78.8	53.0	46.7	41.0	36.1	32.3	30.0	16.6
Div. w/o incorp.	313.4	182.6	124.5	103.9	76.7	52.7	45.1	37.7	32.6	-7.8
Div. with incorp.	219.9	158.8	115.4	74.6	57.8	44.7	35.1	18.5	13.1	8.2

FIG. 4.—Land asset increase by initial endowment

also use a median regression to mitigate the effect of large outliers that may be due to measurement errors.

Following the method proposed by Smith and Blundell, we conduct tests of statistical exogeneity on the *ejido*-level decisions to divide and incorporate.[33] We verify that land inequality, marginal yield, cattle inequality, and the number of *ejidatarios* are valid instruments. The test of residuals shows that we cannot reject statistical exogeneity of these two decisions in the household land assets equations. We consequently proceed with a sample split based on the observed division of the commons and with the observed incorporation of members as an exogenous variable.

When there was no division of the commons (upper part of table 5), results show that the more land an *ejidatario* had in 1994, the less likely his land is to expand in the following period: one additional initial hectare reduces the probability of gaining land by .6% and the quantity of land acquired by .86 hectare. Market forces and exercise of influence are thus mildly progressive. By contrast, being an indigenous household, which is very strongly associated with poverty in Mexico, has a strong negative role, reducing the gain in individual area by 6.4 hectare. Finally, the size of common property land increases gains in individual land, and this has to occur through encroachment since there was no official division.

When there is division of common property land (lower part of table 5), the redistributive effect is much stronger. The probability of gaining access to land when a household has one less hectare of land increases from .6

TABLE 5

CHANGE IN HOUSEHOLD LAND ASSETS BETWEEN 1994 AND 1997

EXOGENOUS VARIABLES (1994)	MEAN	PROBIT INCREASE IN ASSET (0, 1) dF/dx*(%) *P* Value	ORDERED PROBIT DECREASE, NO CHANGE, OR INCREASE IN ASSET Coefficient *P* Value	REGRESSION LAND ASSET INCREASE (ha of RFE) Coefficient *P* Value	MEDIAN REGRESSION LAND ASSET INCREASE (ha of RFE) Coefficient *P* Value†
		In *Ejidos* That Have Not Divided the Commons			
Household characteristics:					
Individual land assets (ha of rain-fed equivalent)	9.6	−.60	−.021	−.86	−.118
		(.01)	(.00)	(.00)	(.05)
Number of adults in the household	3.6	.28	.002	−.09	−.132
		(.88)	(.97)	(.85)	(.14)
Number of adults × distance to city	83.6	.06	.001	.00	.006
		(.38)	(.28)	(.84)	(.29)
Average adult years of education	4.7	−.73	−.024	.16	−.010
		(.41)	(.27)	(.56)	(.85)
Age of head of household	52.7	−.05	−.003	.10	.002
		(.77)	(.44)	(.03)	(.81)
Indigenous household (0, 1)	.16	−4.16	−.100	−6.40	.184
		(.53)	(.53)	(.02)	(.55)
Owns a pickup truck (0, 1)	.18	−.44	.052	2.52	.003
		(.94)	(.69)	(.13)	(.99)
Ejido characteristics:					
Ejido has common land	.76	.51	.000		−.180
		(.94)	(1.00)		(.56)
Common land (ha)	34.9	.08	.002		.007
		(.05)	(.03)		(.03)
Cooperation in CPR (0, 1)	.17	6.21	.070		.102
		(.50)	(.76)		(.78)
Average individual land per *ejidatario* (ha)	11.8	.25	.007		.048
		(.19)	(.13)		(.06)
Distance to nearest urban center (km)	25.0	−.10	−.003		−.014
		(.68)	(.44)		(.41)
Ejido's response to reforms:					
Incorporation of members (0, 1)	.47	−3.56	−.153		−.345
		(.55)	(.27)		(.23)
Mean value of endogenous variable		.505	.324, .17, .503	2.39	median = .12
Number of observations		740	740	740	740

Pseudo-R^2 (probit and median regression)		.03	.03	151 groups	.02
Correctly predicted outcomes		55%	39%	ρ‡ = .62	
		In *Ejidos* That Have Divided the Commons			
Household characteristics:					
Individual land assets (ha of rain-fed equivalent)	8.4	−1.83	−.049	−.61	−.56
		(.00)	(.00)	(.00)	(.00)
Number of adults in the household	3.7	−4.17	−.121	−1.28	−.50
		(.27)	(.24)	(.02)	(.13)
Number of adults × distance to city	94.5	.19	.005	.04	.03
		(.09)	(.06)	(.03)	(.06)
Average adult years of education	4.7	2.22	.070	.88	.45
		(.15)	(.08)	(.00)	(.01)
Age of head of household	52.4	−.18	−.003	.12	.03
		(.44)	(.64)	(.01)	(.41)
Indigenous household (0, 1)	.26	18.30	.434	1.41	1.55
		(.06)	(.07)	(.50)	(.17)
Owns a pickup truck (0, 1)	.14	9.70	.250	4.95	2.14
		(.34)	(.32)	(.00)	(.28)
Ejido characteristics:					
Common land (ha)	37.0	.05	.002	−.03	−.01
		(.47)	(.18)	(.05)	(.60)
Cooperation in CPR (0, 1)	.07	−20.21	−.362	−3.01	−1.80
		(.19)	(.16)	(.26)	(.10)
Average individual land per *ejidatario* (ha)	10.9	1.13	.028	.64	.47
		(.00)	(.00)	(.00)	(.00)
Distance to nearest urban center (km)	26.1	−1.00	−.029	−.11	−.11
		(.05)	(.03)	(.15)	(.01)
Ejido's response to reforms:					
Incorporation of members (0, 1)	.43	−19.11	−.518	−3.03	−1.93
		(.01)	(.01)	(.06)	(.08)
Mean value of endogenous variable		.586	.304, .110, .586	3.09	median = .79
Number of observations		336	336	336	336
Pseudo-R^2 (probit and median regression)		.13	.11	62 *ejidos*	.17
Correctly predicted outcomes		69%	62%	ρ§ = .14	

NOTE.—RFE = rain-fed equivalent. In *ejidos* that have not divided the commons, regression with *ejido* fixed effects; in *ejidos* that have divided the commons, regression with *ejido* random effects. *P* values (contained in parentheses) are for underlying coefficient in probit (standard errors adjusted for clustering on *ejido*).

* Marginal effect calculated at average of exogenous variables. For dummy variables computed as effect of a discrete change from 0 to 1.

† Standard error computed by bootstrapping with 50 repetitions.

‡ Smith-Blundell test cannot reject statistical exogeneity of division and incorporation.

§ Fraction of variance due to random or fixed effects.

without division to 1.8 with division and, although average gain is not different, median gain in hectares is five times larger. Division under democratic governance is thus a strongly equalizing process. We saw in the case studies that land certification indeed often had an equalizing objective. At the same time, having more capital, such as owning a pickup truck, allows *ejidatarios* to acquire more land. Those that gained the most land were consequently the households with smaller land endowments and higher capital assets.

Despite the fact that the number of adults has an insignificant coefficient, an interaction term between the number of adults and distance to the nearest urban labor market is positive. This suggests that, when selling labor off farm is less profitable because of higher transportation costs, households seek instead to expand their land assets.

When there is division, indigenous households have an 18% higher probability of accessing more land. Thus, while market forces and exercise of influence play directly against indigenous households when there is no division, democratic governance in recrafting property rights plays in their favor. Since division under democratic governance (PROCEDE) is itself induced by better-quality land (table 2), expectedly a market response, market forces may indirectly benefit indigenous households through the incentive to divide. We can thus conclude that endogenous changes in property rights under democratic governance were able to reduce both poverty and inequality.

Among *ejido* characteristics, the area in private parcels (average individual land per *ejidatario*) is important because it is the pool of land that can be used for individual transactions. Results show that the average size of private parcels is in all regressions a strong determinant of gains in access to land.

Finally, the *ejido's* response to the reforms in deciding to incorporate new members when there was division strongly reduces gains in access to land for the original members. Thus, while division increases gains in access to land, division with incorporation reduces this gain. Incorporation thus competes with individual gains. This supports the observation made in case studies and in the *ejido*-level analysis that some division of the commons was used to endow new members with land assets of their own.

VI. Conclusions

Following the peasant-led revolution of 1910, the Mexican government distributed half of the nation's agricultural land to peasant communities (*ejidos*). Members of these communities have control over an individual land parcel and, in most cases, access to CPRs. Because dividing parcels was forbidden, and incorporating new members was severely restricted by the state, *ejido* villages have over the years accumulated an increasing number of nonmembers relative to the number of members, generally descendants of members who could not be given land directly by their parents and could not be made members of the community. The 1992 reform of the constitution introduced a land certification program (PROCEDE), which allows the *ejido* assembly

to decide on whether or not to divide the CPR, to incorporate new members, and to change the land allocation across community members, both old and new, using land taken from the commons. Division of the commons could thus be pursued to enlarge individual parcels or to incorporate new members, and land taken from the commons could be allocated to compensate or not for inequalities in individual land endowments.

Changes in property rights from common property to individual parcels has been the object of attention by a number of scholars, such as Boserup and the Property Rights School, J.-M. Baland, and J.-P. Platteau, providing us with a rich set of hypotheses in explaining these changes.[34] Econometric analyses have, however, been few due to lack of data on a sufficiently large number of communities to identify the determinants of change in property rights. The Mexican constitutional reform of property rights in the *ejido* sector provides a vast laboratory to analyze these changes. To do this, we use two surveys, one conducted before PROCEDE and the other after 3 years of implementation. We also use 12 in-depth case studies to find explanations for the determinants of change that can be identified econometrically with the survey data.

Analysis of the impact of the reform at the *ejido* level shows the following:

1. The arguments advanced by Boserup are indeed important: land scarcity in communal *ejidos* pushes toward individualization, and a higher value of the land also induces division across all communities.[35] These divisions are pursued principally for the sake of efficiency gains, not to incorporate new members.
2. When CPRs are abundant in noncommunal *ejidos* and pressure on current members to incorporate new members is high, then both division and incorporation occur. In this case, division is done principally to accommodate incorporation.
3. Greater quality of cooperation in the management of the CPR reduces division. Hence, helping communities improve their capacity to govern would reduce incentives to divide CPRs when there are advantages in preserving them as a unit of management.
4. Finally, inequality matters in the decision of whether or not to divide. As suggested by Baland and Platteau, inequality in economic power (distribution of land parcels) deters division, in part because it creates uncertainties as to how the distributional struggles will be resolved across members.[36] There is, however, another dimension of inequality that creates incentives to divide: inequality in current use of the commons (distribution of herd sizes). In this case, inequality pushes the median voter in *ejido* assemblies to favor division in order to equalize the gains derived from these lands.

Analysis of the impact of the reform at the household level shows that division of CPR served to equalize individual access to land, compensating for inequalities that had developed over time through market forces and ex-

ercise of influence. Households that gained most were those with least land, but also with most working capital. The greatest individual gains in control over land were registered in *ejidos* that decided to divide common land and did not incorporate new members. In these *ejidos*, inequality in access to land among *ejidatarios* declined. Through division, larger gains were secured by indigenous households, the poorest segment of rural society. By contrast, smaller gains were registered in *ejidos* where there was no official division of CPR as gains in control over land could only occur through encroachment on the commons and through the land market. In this case, indigenous households lost land relative to nonindigenous households instead of gaining greater access under state-managed division.

The exercise of local democratic governance in recrafting rights over common property following procedures imposed by the national state has thus been effective in reducing inequality through providing greater access to land for those with smaller endowments and for households belonging to indigenous groups, the poorest segment of Mexican rural society. It has also been effective in incorporating new members in *ejidos*, usually landless descendants of *ejidatarios*. Reforms introduced to provide a more clear definition of property rights, regulated by strict national rules imposed on the communities to secure transparency, democratic participation, and fair conflict resolution, thus resulted in progressive social outcomes.

Notes

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2. Elinor Ostrom, "The Puzzle of Counterproductive Property Rights Reforms: A Conceptual Analysis," in *Access to Land, Rural Poverty, and Public Action*, ed. Alain de Janvry, Gustavo Gordillo, Jean-Philippe Platteau, and Elisabeth Sadoulet (Oxford: Oxford University Press, 2001).

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4. Jean-Marie Baland and Jean-Philippe Platteau, *Halting Degradation of Natural*

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5. Garrett Hardin, "Living on a Lifeboat," *Bioscience* 24 (1974): 561–68.

6. Robert Wade, *Village Republics: Economic Conditions for Collective Action in South India* (Cambridge: Cambridge University Press, 1987); Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (New York: Cambridge University Press, 1992); Baland and Platteau, *Halting Degradation of Natural Resources.*

7. Jeffrey Nugent and Nicolas Sanchez, "The Local Variability of Rainfall and Tribal Institutions: The Case of Sudan," *Journal of Economic Behavior and Organization* 39, no. 3 (1999): 263–91.

8. Mancur Olson, *The Logic of Collective Action: Public Goods and the Theory of Groups* (Cambridge, Mass.: Harvard University Press, 1965); Albert Hirschman, *Getting Ahead Collectively: Grassroot Experiences in Latin America* (New York: Pergamon, 1984); Pranab Bardhan, "Irrigation and Cooperation: An Empirical Analysis of 48 Irrigation Communities in South India," *Economic Development and Cultural Change* 48, no. 4 (2000): 847–65; Alain de Janvry, Céline Dutilly, Carlos Muñoz-Piña, and Elisabeth Sadoulet, "Liberal Reforms and Community Responses in Mexico," in *Community and Market in Economic Development*, ed. Masahiko Aoki, Douglas North, and Yujiro Hayami (Oxford: Oxford University Press, 2001).

9. Jean-Marie Baland and Jean-Philippe Platteau, "Division of the Commons: A Partial Assessment of the New Institutional Economics of Land Rights," *American Journal of Agricultural Economics* 80, no. 3 (1998): 644–50; this is an argument similar to that used by Alberto Alesina and Allan Drazen, "Why Are Stabilizations Delayed?" *American Economic Review* 81, no. 5 (1991): 1170–88, and also Raquel Fernández and Dani Rodrik, "Resistance to Reforms—Status Quo Bias in the Presence of Individual-Specific Uncertainty," *American Economic Review* 81, no. 5 (1991): 1146–55, in analyzing opposition to stabilization and trade reforms.

10. Boserup.

11. Douglas North, *Institutions, Institutional Change, and Economic Performance* (Cambridge: Cambridge University Press, 1990); Wade; Elinor Ostrom, *Crafting Institutions for Self-Governing Irrigation Systems* (San Francisco: Institute for Contemporary Studies Press, 1992).

12. Otsuka and Place.

13. Gustavo Gordillo, Alain de Janvry, and Elisabeth Sadoulet, "Between Political Control and Efficiency Gains: The Evolution of Agrarian Property Rights over Land in Mexico," *CEPAL Review* 66 (1998): 151–69.

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15. Daniel Klooster, "Institutional Choice, Community, and Struggle: A Case Study of Forest Co-Management in Mexico," *World Development* 28, no. 1 (2000): 1–20.

16. Nancy McCarthy, Alain de Janvry, and Elisabeth Sadoulet, "Land Allocation Under Dual Individual-Collective Use in Mexico," *Journal of Development Economics* 56, no. 2 (1998): 239–64.

17. Baland and Platteau, "Division of the Commons."

18. Olson (n. 8 above).

19. Amy Poteete, "Strategies for Regulating Use of Forest Resources: How Exclusive?" (Bloomington: International Forestry Resources and Institutions Research Program, Indiana University, 2001, mimeographed), in reviewing the determinants of exclusion from a group for the purpose of regulating extraction in forestry communities, thus found that the most important factor is the nature of the political relation among users.

20. Fieldwork for these case studies was done jointly with Céline Dutilly-Diane. See her "Collective Action and Partial Cooperation in the Management of Common Property Resources" (doctoral diss., in French, Université d'Auvergne, Centre d'Etudes et de Recherche sur le Développement International, 2001).

21. The Wald test of zero correlation between the two error terms in the bivariate probit has a *P* value of .63. Hence, the hypothesis of zero correlation cannot be rejected.

22. Richard Smith and Richard Blundell, "An Exogeneity Test for a Simultaneous Equation Tobit Model with an Application to Labor Supply," *Econometrica* 54, no. 3 (1986): 679–85.

23. The other PROCEDE variable, whether a first meeting was held with program officials, is exogenous as it is decided by PROCEDE.

24. Boserup, *The Conditions of Agricultural Growth* (n. 1 above).

25. Ibid.

26. McCarthy, de Janvry, and Sadoulet (n. 16 above).

27. Olson; Hirschman (n. 8 above).

28. Baland and Platteau, "Division of the Commons."

29. Otsuka and Place (n. 3 above).

30. See the suggestions made by Jean-Philippe Platteau and Anita Abraham, "Participatory Development in the Presence of Endogenous Community Imperfections," *Journal of Development Studies* 39, no. 2 (2002): 104-36.

31. Tests of difference in Ginis were developed by bootstrapping of observations with replacement and 500 replications. The *t*-test is −.30 for the difference (.53−.54) with no incorporation and no division, 1.70 for the difference (.56−.52) with incorporation and no division, and −1.68 for the difference (.51−.55) with division and no incorporation. At a 90% significance level, the first difference is not significant while the latter two are.

32. In the sample, 11.2% of the *ejidos* are 100% indigenous, 13.1% partially indigenous, and 75.7% have no indigenous members.

33. Smith and Blundell (n. 22 above).

34. Boserup; Baland and Platteau, "Division of the Commons."

35. Boserup.

36. Baland and Platteau, "Division of the Commons."