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# Assets, activities and income generation in rural Mexico: Factoring in social and public capital

by

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## Abstract

In recent years, there has been increasing emphasis in the rural development literature on the multiple income-generating activities undertaken by rural households and the importance of assets in determining the capacity to undertake these activities. Controlling for endogeneity choice and applying Lee's generalization of Amemiya's two-step estimator to a simultaneous equation model, household returns to assets from multiple activities are explored for the Mexico ejido sector. To incorporate the multiple variables representing social and public capital into the analysis, factor analysis is used. The results indicate that the asset position of the household has a significant effect on household participation in income-generating activities and returns to those activities. Furthermore, the inclusion of measures of social and public capital into the analysis show that these assets play an important role in income-generating activities and that the influence is dependent on the type of social and public capital as well as the particular activity.

Key Words: livelihoods, Mexico, social capital, public capital, agricultural households, censored regression

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## 1. Introduction

In recent years, there has been increasing emphasis within the rural development literature on what is referred to as rural livelihoods and livelihood diversification. A key feature of the concept of livelihoods is the link between assets, activities and income and the role of the institutional context in determining the use of and returns to assets. For example, Ellis (2000) defines a livelihood as comprising "the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by an individual or household." Livelihood diversification is then the process by which households construct a diverse portfolio of activities and assets to survive and improve their standard of living (Ellis, 2000).

The livelihoods approach has played an important role in highlighting the multiple activities undertaken by rural households, the importance of assets in determining the capacity to undertake activities, the dynamic nature of the actions of rural households and the link between the diversification of assets and activities (Barret and Reardon, 2000). Evidence from developing countries indicates that rural households rely on a number of assets and employ multiple activities to generate income. In particular, there has been strong evidence indicating the increasing importance of rural nonfarm activities. Reardon, et al (2001), for example, show that, based on a set of studies from Latin America, rural nonfarm activities make up 40 percent of rural household income. Furthermore, the trend is toward greater nonfarm activities for rural inhabitants.

While the livelihoods approach has contributed to our understanding of rural household behavior, there has been little empirical examination of the approach. A number of recent studies have recognized the role of a diverse set of assets in income-generating activities. For example, Lanjouw (1999, 2001) examines nonfarm income in Ecuador and El Salvador using assets such as human capital (education, literacy), natural capital (land) and public capital (electrification, water connection) as explanatory variables. Winters et al (2001) explore the role of assets, including social and public capital, in the decision to migrate. Corral and Reardon (2001) and de Janvry and Sadoulet (2001) explore the importance of natural, human, social and public capital in the generation of income in Nicaragua and Mexico respectively. While recognizing the importance of assets in income-generating activities, these studies do not consider both the simultaneous nature of asset allocation and the selectivity bias created by the decision to participate in an activity.

One recent study that does consider these issues is by Taylor and Yuñez-Naude (2000). Their paper focuses on the returns to schooling from a diverse set of activities in rural Mexico broadening consideration to both household head and family schooling. Taylor and Yuñez-Naude's paper is interesting from an econometric point of view in that they carefully address issues affecting bias and inefficiency in parameter estimates. By controlling for endogeneity of activity choice and using Lee's generalization of Amemiya's two-step estimator in a simultaneous-equation model, the resulting estimators are asymptotically more efficient than other two-stage estimators, such as the commonly used Heckman procedure.

In this study we use the same econometric approach as Taylor and Yuñez-Naude to explore livelihood strategies in the Mexican ejido sector. Unlike Taylor and Yuñez-Naude, our main interest lies in exploring the importance of community level factors, particularly social and public capital variables, in the participation in and returns to income-generating activities. Empirical evidence suggests that along with other forms of capital, social and public capital play an important role in household income-generation. For example, an analysis of Tanzanian households shows that higher levels of social capital are associated with greater levels of expenditure (Narayan and Pritchett, 1999). Understanding the role of social and public capital in income generation has important policy implications for governments. If governments decide to invest resources into alleviating poverty, then it is essential to know how social and public capital influence income generation. Incorporating social capital and community level variables representing public capital into the analysis of assets and activities has proved problematic since these assets are generally difficult to measure in a way that truly represents the specific attributes of these assets and reflects how households secure benefits from them. We address this issue by using factor analysis to identify specific factors to represent social and public capital.

The remainder of this paper is divided into 4 sections. Section 2 provides a conceptual background for the relationship between assets, activities and income and discusses the empirical strategy for examining the use of assets in income-generating activities. Section 3 uses the Mexico data to define the set of assets rural Mexican household use for generating income. Participation in activities and returns to assets are examined using the Taylor and Yuñez-Naude (2000) empirical approach. In section 4, the issue of measuring and including social and public capital is addressed. Measures of these assets calculated using factor analysis are then included in the activity equations. Finally, in section 5 conclusions are discussed.

## 2. Rural livelihood strategies: Conceptual framework and empirical approach

The basis of a livelihood strategy is the asset position of the household at a given point in time. Note that, as has become standard practice, household assets are defined broadly to include natural, physical, human, financial, public, household and social capital.[1] These assets are stocks, which may depreciate over time or may be expanded through investment. Based on access to a particular set of assets for a given period, the household must decide which activities it will employ and the intensity of involvement in that activity. For purposes of this paper, activities are actions taken by the household to produce income. They involve the use of a single asset or a set of assets. Agricultural production, for example, may use natural capital in the form of land and water, human capital, physical capital such as tractors, financial capital for the purchase of inputs and social capital in the form of labor assistance by community members. Alternatively, nonfarm wage employment may only use human capital. The intensity of an activity depends on the degree to which assets are used. A strategy of agricultural intensification is likely to involve a greater use of human capital and financial capital (for the purchase of inputs) than a strategy that focuses on other activities or in less intensive agricultural production. The decision on the set of activities a household will employ and the intensity of those activities is conditioned on the context in which the

[1] The types of capital that households access can be categorized in a variety of manners. One common categorization is to define four types of capital: natural, human-made (physical), human and social (Serageldin and Steer, 1994). Our categorization reflects a desire to provide greater detail in the types of capital used by households although each of these categories can be subsumed in one of the four categories commonly presented.

household operates. The context influences household decisions through natural forces, markets, state activity and societal institutions.

Conceptually, the mapping of assets to income through activities can be viewed as similar to a production process, with assets corresponding to factors of production and income as the output of the process (Barret and Reardon, 2000). The return to assets then depends on the parameters of the functions, which are determined by prices of inputs and outputs as well as other characteristics of the context. The allocation of assets to each activity is expected to maximize household income subject to a number of constraints. Households will allocate assets in a manner that equates the marginal value product across activities or will allocate assets entirely to one activity that has a superior return.

One of the key features of this approach is that households simultaneously determine the allocation of assets to different activities. Failure to consider the simultaneous nature of the decision can lead to curious and often contradictory results across different studies. For example, Taylor and Yuñez-Naude (2000) note that research on the returns to schooling in rural economies range from high to negative. They argue that the reason for this is that researchers have failed to take into account the technological changes and sectoral diversification that characterize agricultural transformation in developing countries. Households may reap the awards from schooling through abandoning or limiting one activity in favor of another. A low or negative return to schooling in crop production, for example, may mean that the more educated have shifted to other activities such as non-farm employment. Similarly, this logic holds for all assets. If the government puts a paved road through to a community then this may cause some households in that community to alter income-generating activities. Researchers focusing on a single activity may find that investment in infrastructure reduces income from that activity, which may lead to perverse policy implications. While this may be the case, analysis of a single activity ignores the benefits of infrastructure in other activities. Only through the considering all income-generating activities simultaneously can this problem be avoided. The issue we then want to examine in this paper is the relative importance of different assets in the activities chosen by rural Mexican households, with particular emphasis on social and public assets.

The household's decision on the allocation of assets across activities is a simultaneous decision and one that is censored by the fact that households do not necessarily participate in all possible activities. Some households will therefore have zero income from, for example, self-employment.[2] Examining the allocation and returns to assets requires a simultaneous equation model in which the dependent income variables are censored by unobservable latent variables influencing the activity participation decision. Households obtain income from an activity only if they participate in that activity. Participation in an income-generating activity occurs if the household believes the expected returns to that activity are greater than the alternative of not participating.

The econometric approach follows Lee's generalization of an estimation principle of Amemiya (1977a, 1977b) in a general simultaneous equation model. Lee compared Amemiya's generalized two-stage estimators with other two-stage estimators, and showed that Amemiya's estimators are more efficient in all cases, including those proposed by Heckman. This econometric specification allows for censored dependent variables, where unobservable latent variables influence the decision to participate in an activity. Recently, Taylor and Yuñez-Naude (2000) utilized Lee's generalization in their study of returns to schooling in both crop and noncrop activities in rural Mexico, and we follow their empirical

[2] Table 1 notes the participation rates for each activity. Less than half of households participate in non-agricultural wage employment, agricultural wage employment, self-employment and migration.

approach. In the first step, probits using the complete set of asset variables as explanatory variables are estimated. The probit on each income-generating activity measures the effects of assets on household participation in that activity. The probits are also used to calculate inverse Mill's ratios (IMR), which are included in the second step to control for selectivity bias. The second step is to estimate the income equations including an IMR as a right-hand side variable in each of the corresponding income equations. The income equations are estimated jointly, to reflect the simultaneous nature of the decision, for the full household sample using three stage least squares which allows the inclusion of information contained in the cross-equation error correlations. For the income equations, only assets that are expected to affect the income level of that activity are included as right-hand side variables.

The data used in this study comes from a nationally representative sample of Mexican ejido, or land reform, households. Data were collected at two points in time during the Spring and early Summer of 1994 and 1997, for 972 households.[3] The survey covered a wide array of household assets as well as household demographics, income-generation activities and participation in organizations. Community-level data was also collected on characteristics and organization of the ejido. Most of the data used in this analysis, including the income data, is from the 1997 survey except in some cases where 1994 data was used to avoid endogeneity problems.

## 3. Assets and income-generating activities

Household activities can be divided into six categories: crop production, livestock production, self-employment, non-agricultural wage employment, agricultural wage employment and migration. Table 1 presents data on these activities. On average households earned 10,888 pesos in 1997. Not all households participate in every activity. A majority of households participate in crop (93.7 percent) and livestock (75.3 percent) production but few participate in self-employment (17.2 percent) and migration (15.8 percent). Agricultural activities (crops, livestock and agricultural employment) make up 55 percent of total rural household income showing that nearly half of income is generated by non-agricultural activities. Crop income represents about 30 percent of total income in 1997 and is the most important source of income followed by non-agricultural wage income (27.1 percent). However, only 42.3 percent of households participate in non-agricultural wage employment and for those that do it is the most important income-generating activity (52.8 percent of total income). Similarly, households that participate in self-employment and migration receive, on average, one-third of their income from this activity. A number of agricultural households have thus shifted away from agricultural to non-agricultural activities.

Asset ownership varies significantly across the ejido sector. In Table 2 explanatory assets are grouped into the following categories—natural (land), physical (livestock, equipment), human (education, gender, labor, labor experience and ethnicity), financial (credit), and migration (U.S. and Mexico migration networks). Regional variables are also included to control for unobserved factors. On average, households have substantially less irrigated land than either rainfed or pasture land. For the 25 percent of households with irrigated land, average size is 5.2 hectares. . Although overall households hold an average of 6.4 heads of cattle, over half own no livestock. Those households with livestock own on average 13.5 heads. Education level is divided by gender as we hypothesize that the returns to human capital vary by this differentiation. As would be expected, the average number of

[3] The Secretariat of Agrarian Reform and the World Bank carried out the surveys with assistance from the University of California, Berkeley. A detailed description of the Mexico data and its sampling properties can be found in Cord (1998).

male and female household members decreases with increasing levels of education. Labour composition and experiences vary significantly across households.

Table 3 presents the results of the probits on activity participation for 1997. Coefficients with a level of significance greater than 90 percent are in bold. Almost all households have some crop production, so results for that activity are not particularly interesting. Rainfed land and livestock ownership positively influence participation in livestock production while irrigated land and tractor ownership are negatively associated with livestock participation. This is not surprising since these latter assets are likely to have higher returns for crop production. For a similar reason, tractor owners are less likely to participate in self-employment. Natural and physical capital reduces participation in both forms of wage employment. The positive association between rainfed land and remittance income may indicate that participation in migration requires at least a minimal wealth level. Education, particularly among males, plays a strong role in non-agricultural wage employment. Minimal male education, that is literacy, seems to play a similar role in livestock production. Higher levels of male education are negatively associated with receipt of remittances. Younger households (as indicated by age of household head) are more likely to participate in agricultural wage employment, and older households in receiving remittances. The presence of young males, controlling for education, leads to increased participation in agricultural wage labor, while the presence of older males leads to greater participation in crop production. Previous experience in non-agricultural activities (self-employment and non-agricultural wage earning) not surprisingly leads to greater probability of participation in each respective activity. However, previous experience in agricultural wage employment leads to greater participation in crop production, agricultural wage earning and migration. Somewhat surprisingly, access to formal credit in 1994 does not influence participation in any activities in 1997. This could be because credit is primarily tied to crop production. Indigenous households are more likely to participate in on farm activities and less likely to migrate. A number of regional variables are associated with particular activities suggesting there are certain regional factors that influence participation that are not controlled for in the regression. Finally, migration networks are most important for receiving remittance income.

Table 4 presents the results of the selectivity corrected system estimates of the income equations. While the probits evaluated the probability of participation in activities, the income equations examine the factors influencing the level of income from each activity. Note that in all estimates, except for self-employment, the IMR is significant at the 95 percent level or above. This indicates that self-selection into activities is an important factor in considering the income-generated from a particular activity and failure to control for this would have led to biased results.

Assets play a variety of roles in terms of the generation of income by activity. Land size, particularly irrigated land, is important for on-farm categories as well as self-employment and remittances. Rainfed land is important for livestock income, as it serves as an input into livestock production. Rainfed land is also important for self-employment suggesting that farmers with more land are able to earn more though self-employment than others. Education provides the most interesting story. Education is most important, not surprisingly, for non-agricultural wage labor, though this varies by gender. All levels of male education lead to higher off farm income, while only the highest level of female education has a positive — and significant — coefficient. On the other hand, the number of females aged 15-34, holding education constant, is positive and significant, signalling that lower levels of female education are not valued on the labor market. This is presumably due to the kind of entry level employment rural women can choose from, such as domestic servant. Female education is also important for self-employment income, and surprisingly, livestock income.

Both higher levels of male and female education are associated with higher agricultural income, suggesting that education only becomes important when it reaches a certain technical level.

## 4. Adding social and public capital

The purpose of this section is to discuss a method for the inclusion of community variables, including social and public capital, in the analysis of income-generating activities and to present the results of the analysis. There has been some debate over the precise definition and measure of social capital (Woolcock and Narayan, 2000). Social capital can be defined as a variety of different entities with two common elements: they all consist of some aspect of social structure and they facilitate actions of actors within that structure (Coleman, 1988). For our purposes, social capital is the social relations, both vertical and horizontal, that help facilitate the generation of income. Since our interest is in examining the community factors that facilitate income generation we focus on relations at that level. Households may belong to a set of formal and informal organizations that may provide direct or indirect assistance in economic activities. For example, membership in a women's group may provide information on market opportunities for nonfarm products. In addition to membership in individual organizations, the ejidos in which households live may be well or poorly organized which will also affect the households' ability to generate income. Finally, vertical ties to, for example, organizations that provide technical assistance will influence income-generation. Each of these is considered as part of social capital. Another asset that is difficult to measure and plays an important role in income generation is public capital, which involves access to public goods and services. These include a range of services and infrastructure from health care and telephone access to electricity and paved roads.

Calculating the value of social and public capital is complicated by the diversity and multiplicity of indicators. Households belong to a range of organizations both formal and informal and ejidos may have different types of organizational structure. Infrastructure and services differ in terms of their presence and importance in a community. Table 5 lists a variety of community variables that may be used as public and social capital indicators. They range from measures of ejido organization and household participation in organizations to the distance to various public services, the level of community infrastructure and direct household access to publicly provided infrastructure.

The challenge for analyzing the benefits of social and public capital in income-generating activities is determining a method for using the information contained in these large sets of variables. Two options have generally been used. The first is to create a single numerical index that is a weighted average of the relevant set of variables. A higher value for the index implies, for example, greater social capital. The index is then used in subsequent analysis such as analysis of income generation using regressions. Narayan and Prichett (1999) use this approach to examine household income generation in rural Tanzania. The problem with this approach is that it requires strong and somewhat arbitrary assumptions about the weights for each variable in the aggregation. Furthermore, this method assumes that a single numerical index is sufficient to represent social or public capital. However, as with other forms of capital, social and public capital are not homogenous entities. The World Bank (2000), for example, identifies three types of social capital: bonding, bridging and linking social capital. A single index ignores this possibility. Even if multiple indexes were to be created to measure the various types of social or public capital, defining the different indexes would still be arbitrary.

The second approach to including social and public capital variables in income analysis is to use all or a subset of the variables directly in income regressions. For example, de Janvry and Sadoulet (2001) in evaluating the determinants of income in the ejido sector include social and institutional assets (indigenous household and access to technical assistance) and locational characteristics (number of urban centers within 1 hour, number of rural centers within an hour and regional dummies). One problem with this approach is in deciding which variables adequately represent the presence of social and public capital. Which variable in Table 5, for example, represents the level of infrastructure in a community? The problem with including all or even a significant number of variables in regression analysis is that this specification can lead to problems with degrees of freedom, if the sample is not sufficiently large, and multicolinearity if, as is likely, the multiple social and public capital variables are highly correlated. In the presence of multicolinearity, identification is not a problem but with highly correlated variables estimates are less precise (Greene, 1997).

Given the shortcomings of these two methods, in this paper a third method, factor analysis, is used to incorporate social and public capital into the analysis of income generation. The primary purpose of factor analysis is to describe the relationships among many variables in terms of a few underlying, but unobservable, *factors* (Johnson and Wichern, 1988). Factor analysis groups sets of variables by their correlations and each group of variables represents a single underlying construct or factor.[4] For example, Kline and Wichelns (1996) use factor analysis to evaluate respondents' perceptions of farmland preservation programs. Based on reasons provided for preserving farmland, they identify four factors that seem to explain preferences: environmental objectives, aesthetic objectives, agrarian objectives and anti-growth objectives. Similarly, using the multiple measures of social and public capital, the underlying factors that represent the important characteristics of these assets can be determined. In one such study, Onyx and Bullen (2000), using a set of 36 measures of social capital from five Australian communities, identify eight factors that represent social capital including community participation, agency and trust. While factor analysis does assist in identifying underlying factors represented by a set of variables, the method is subjective and requires interpretation of the factors to give them meaning. This interpretation relies on previous knowledge and intuition about underlying relationships.

For this study, factor analysis was used to identify factors that represent the important elements of social and public capital. Social and public capital are not necessarily homogeneous and more than one factor was expected to emerge for each set of variables. Social and public capital variables were analyzed using the principal component factor method and rotated using the varimax rotation method.[5] Typically, factors are retained in the analysis if their eigenvalues are greater than one. To limit the number of factors retained that value was increased to 1.25, which allows more straightforward interpretation of factors. Even with this limitation, as will be seen below, interpreting some of the factors is difficult. At that cutoff, eight factors were retained which represented 44 percent of the variance.[6]

[4] Factor analysis is similar to principal components analysis in that both are attempts to approximate the covariance matrix. However, factor analysis is more elaborate and the primary question it seeks to ask is whether the data are consistent with some underlying structure (Johnson and Wichern, 1988).

[5] As recommended as a first step by Johnson and Wichern (1988). Additional methods including the iterated principal factor method and the maximum likelihood factor method. Since these approaches tended to bring about similar solutions the original principal components factor method was used.

[6] This corresponds to the 49 percent of the variance explained by the eight factors identified by Onyx and Bullen (2000).

Results of the factor analysis are presented in Table 6. As is standard practice, only factor loadings greater than 0.25 are retained for interpretation.[7]

Factor 1: Proximity

This factor indicates the proximity of the community to infrastructure, services and urban areas. This is evidenced by the high negative loadings on distance to a health clinic (-0.45), post office (-0.84), telegraph (-0.80) and a fax (-0.88) and the time (-0.76) and distance to an urban center (-0.84). Households with a positive association with this factor tend to be less remote than those negatively associated with this factor.

Factor 2: Ejido population size

This factor is associated with ejidos that have a substantial population, which is accompanied by access to substantial community services and infrastructure. The positive association with a Diconsa and Liconsa store, the presence of a meeting room, secondary school and high school shows this. The negative association with distance to a health center and post office also indicates a large community with access to those services. The negative association with PROCEDE reforms and the positive association with environmental degradation are indicators of the cooperation problems associated with having a large ejido — difficulty in organizing the reform process and difficulty in managing the resource base.

Factor 3: Semi-urban

This factor appears to represent ejidos that are semi-urban. The number of urban centers within an hour has a large coefficient (0.62) as does the number of rural centers within an hour (0.35). Given this is the case it is not surprising to see a positive association with share of roads that are paved, DICONSA store, meeting room, secondary school and telephone access. An ejido near an urban or rural center is more likely to have greater infrastructure and services. There is also a positive association with the PROCEDE reform. Since this reform leads to the allocation of individual property rights, it is likely to be the case that the reform process will occur in areas where land can be more easily sold or rented, as is generally the case in semi-urban areas. Finally, there is a positive relationship with informal organization participation. Again this could be associated with a semi-urban setting where populations tend to be denser and organizing for cultural and economic reasons is easier.

Factor 4: Cooperation

This factor clearly represents cooperation within the ejido as evidenced by the strong loading on households frequently participating in assemblies (0.72), respecting community agreements (0.71) and belonging to informal organizations (0.40).

Factor 5: Lack of formal production arrangements

This factor describes the lack of formal production organization in the ejido, as there is a strong negative association with ejido belonging to ARIC (-0.63). Furthermore, a

[7] While it is was necessary to settle on one set of results to present in the paper, as noted, a number of methods of factor analysis were explored. Although the order of the factors differed across method, the results were largely consistent across methods. That is, the loadings and relevance of certain variables tended to be the same across methods suggesting these factors do represent some underlying structure in the data.

substantial number of households associated with this factor do not participate in "other" formal organizations (-0.54), production contracts (-0.48) and the government technology transfer program (-0.48). There is a somewhat peculiar positive association with household agreement on the use of common lands.

Factor 6: Household access to infrastructure

This factor represents the degree to which households have access to services as indicated by the strong loadings on water (0.46), sewage (0.75), bathrooms (0.72) and telephone (0.48) access. Households positively associated with this factor also tend to have a lower share of the population speaking an indigenous language and lower environmental problems. This partially reflects that indigenous households tend to live in more marginalised communities.

Factor 7: Infrastructure

This factor shows the degree of access to infrastructure. This is evident through the strong loadings on lighting (0.71), electricity (0.66), share of paved roads (0.48) and water access (0.35). The results indicate that ejidos that have formal organizational structure tend to have this type of infrastructure and those with informal organizations are less likely to have the corresponding infrastructure.

Factor 8 Formal ejido organization

This factor represents an ejido that has formal organizational structure, indicated by the factor loadings on ejido membership in a campesino organization (0.59) and ejido union (0.33) as well as the participation in production contracts (0.36). The high loading on communal lands per capita (0.32) may indicate a community with a need for formal structures. Access to emergency work and paved roads may also be an indicator of the community's ability to organize and lobby government officials for assistance.

The results suggest that social and public capital are not homogenous and a number of factors represent their role in income generation. This calls into question the use of single indicators of social or public capital. Using these factor loadings and the regression method suggested by Thomson (1951), a new set of variables representing each of the eight factors can be generated.[8] As is standard practice, the factors are normalized to have a mean 0 and standard deviation 1. Using these measures of social and public capital, the two-step econometric procedure outlined in section 2 and presented in Tables 3 and 4 were re-estimated. Table 7 presents the new results of the probits for activity participation. The majority of the results remain the same as the preliminary estimations suggesting their robustness. Results that differ from Table 3 are put in italics.

Participation in activities appears to be influenced by a number of social and public capital factors. Proximity to an urban center is found to be negatively associated with agricultural wage employment as well as remittance income. This most likely reflects the fact that isolated households have few non-agricultural options other than agricultural wage employment or migration. Households in ejidos with large populations appear to be less likely to participate in livestock production, reflecting problems in managing the resource base. Not surprisingly, households in a semi-urban setting are more likely to participate in self-employment and non-agricultural wage employment, as the opportunities for households

[8] Cited in the STATA reference manual.

living in these settings are much higher. Receipt of remittance income is less likely in a semi-urban setting and is also negatively associated with infrastructure and formal organisation again suggesting that dependence on external transfers may be the only alternative in the face of limited opportunities. Household access to infrastructure is positively associated with self-employment, as many microenterprises require minimal infrastructure access. Finally, formal organization in the ejido is positively associated with participation in crop production, livestock production and non-agricultural wage employment. The ejido organizational structure clearly influences the choice of income-generating activities.

Table 8 presents the results of the selectivity corrected system estimates of the income equations including the social and public factors. As with the probits, the majority of the results remain the same as in Table 4. One notable exception relates to male education levels. The results from Table 8 suggest that higher levels of male education are negatively associated with livestock income. Taken together the results suggest that households with significant male education concentrate on non-agricultural wage employment and crop income (for those with tertiary education).

Moving to the examination of the social and public capital variables, a number of these variables significantly influence the level of income generated from each activity. Proximity to an urban center positively influences the level of crop income while semi-urban status is negatively associated with crop income. This suggests a non-linear relationship in the benefits of urban access. Households that are very near urban and rural centers are likely to earn less income than households further out on the periphery of these centers. However, households that are very far away earn significantly less income. The results also indicate that households with access to basic infrastructure such as water, sewage, bathrooms and telephones earn higher income from crop production. A similar result is found for livestock income, self-employment and non-agricultural wage employment. These results indicate that a community with substantial household access to these types of infrastructure is likely to have greater income-generating opportunities.

Lack of formal production arrangements appears to limit crop, livestock and self-employment income (meaning that the presence of formal production arrangements would improve income from these sources). These formal production arrangements seem to play an important role in increasing the level of income received by households. However, formal ejido organization is negatively associated with livestock income. These results provide evidence for the view that the types of social and public capital matter. Both of these variables are indicators of social capital as they measure associational activity. However, only an association with productive oriented organizations has a positive influence on livestock income. Both non-agricultural and agricultural wage income are positively related to the level of infrastructure. Ejidos with access to electricity, lighting, water and paved roads, general indicators of economic development, provide higher wage employment income than those without.

## 5. Conclusion

The livelihoods approach to understanding the behavior of rural households in developing countries has highlighted the importance of assets in determining the capacity of households to undertake certain income-generating activities. Analysis of the Mexico ejido sector presented in this paper suggests that the household's asset position has a significant effect on household participation in specific activities as well as on the level of income earned from those activities. Households choose a portfolio of activities and the intensity of involvement in those activities based on their asset position. Given this is the case, partial analysis of

income generation — that is, the analysis of a single income-generating activity — can potentially lead to incorrect conclusions about the role of a particular asset in income generation. For example, our results indicate that high levels of male education result in greater participation and returns to non-agricultural wage employment but lower income from livestock production. While these results mirror the general conclusion of Taylor and Yuñez-Naude (2000) that returns to schooling vary across activity, we find that education participation and returns differ across gender and that the return to education is primarily through non-agricultural wage employment and crop production. While the returns for crop income for men and women at the highest level of education are similar, lower levels of female education are not valued on the labor market. This is due primarily to the type of employment young rural women are limited to: domestic help.

Along with other household assets, social and public capital assets are found to play an important role in household participation in activities and the level of income generated by each activity. By using factor analysis, the forty community variables are reduced to four public capital factors — proximity, semi-urban status, household access to infrastructure and general infrastructure —, three social capital factors — cooperation, lack of formal production arrangements and formal ejido organization — and one factor — ejido size — that shows the effect of ejido population on both public and social capital. These factors represent the key community characteristics and are likely to influence household behavior. Their heterogeneity suggests that each will influence that behavior in a unique manner, and inclusion of these factors in the regression analysis shows this influence. Creation of a single index of social or public capital would have ignored the importance of the heterogeneity, and using a subset of social and public capital variables would have led to ambiguity regarding the reason for the effect since each indicator might represent multiple components of social and public capital. Factor analysis provides an alternative to these methods and identifies the particular manner in which social and public capital influence income generation.

The results from the regression analysis indicate that ejido organization is important in determining participation in crop and livestock production, non-agricultural wage employment and remittance income. The location of the household relative to urban areas (proximity and semi-urban status) is also important in influencing participation in self-employment, non-agricultural and agricultural wage employment and remittance income. In terms of income levels, lack of formal production arrangements hinders agricultural and livestock income generation, as well as self-employment. The type of infrastructure accessible by the household affects income level with household level access to infrastructure associated with greater levels of all kinds of income, with the exception of agricultural wage and remittance, and general infrastructure access associated with higher levels of both types of wage labor. Finally, while being very close to urban or rural centers limits crop production income, a degree of proximity to urban centers improves crop production income.

The findings presented in this paper have a number of implications for Mexican government policy towards the ejido sector. First, although all ejiditarios have access to land, many are no longer dependent on agricultural production for most of their income and are using the assets at their disposal for a number of income-generating activities. Policies designed to improve agricultural production will not necessarily have the desired or expected effect since households may respond by shifting assets to other activities. Second, social and public capital variables have an important influence on income generation. In designing policies to improve the income-generating capacity of ejiditarios, such as policies to alleviate poverty, the government needs to recognize the role of these factors. For example, based on the results presented in this paper, if the Mexican government wished to embark on a strategy of improving non-agricultural employment opportunities for ejiditarios then it might begin by

taking actions to improve ejido organization (although this might also induce participation in crop and livestock production). Additionally, it might improve household access to both household level and general infrastructure since each of these enhances the level of income earned from non-agricultural employment. Similarly, if the government decided to put resources to generally improving income levels then investing in household access to infrastructure is likely to have the broadest and greatest impact on income levels. Ignoring the role of social and public capital in the ejido sector would constitute a missed opportunity.

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**Table 1: Income and activities**

Number of household = 972

| | |
|---|---|
| *Household Income* | |
| Mean household income | 10888 |
| *Crop income* | |
| Mean income for all households | 3331 |
| Percent of total household income | 30.6% |
| Percent participating | 93.7% |
| Mean income for participating households | 3554 |
| Percent of income for participating households | 32.6% |
| *Livestock income* | |
| Mean income for all households | 2071 |
| Percent of total household income | 19.0% |
| Percent participating | 75.3% |
| Mean income for participating households | 2750 |
| Percent of income for participating households | 24.9% |
| *Self employment income* | |
| Mean income for all households | 1234 |
| Percent of total household income | 11.3% |
| Percent participating | 28.2% |
| Mean income for participating households | 4378 |
| Percent of income for participating households | 33.0% |
| *Non-ag wage income* | |
| Mean income for all households | 2946 |
| Percent of total household income | 27.1% |
| Percent participating | 42.3% |
| Mean income for participating households | 6968 |
| Percent of income for participating households | 52.8% |
| *Ag wage income* | |
| Mean income for all households | 582 |
| Percent of total household income | 5.3% |
| Percent participating | 17.2% |
| Mean income for participating households | 3388 |
| Percent of income for participating households | 31.0% |
| *Remittance income* | |
| Mean income for all households | 724 |
| Percent of total household income | 6.6% |
| Percent participating | 15.8% |
| Mean income for participating households | 4570 |
| Percent of income for participating households | 32.1% |

**Table 2: Assets**

Number of household = 972

| Capital | Variable | Mean/percent |
|---|---|---|
| *Natural* | Irrigated land (hectares) | 1.3 |
| | Rainfed land (hectares) | 7.5 |
| | Pasture land (hectares) | 4.3 |
| *Physical* | Livestock ownership, 1994 | 6.4 |
| | Tractor ownership, 1994 | 7.5% |
| | Truck ownership, 1994 | 17.1% |
| *Human* | Males educ. - literate | 0.7 |
| | Males educ. - primary | 0.5 |
| | Males educ. - secondary | 0.3 |
| | Males educ. - tertiary | 0.1 |
| | Females educ. - literate | 0.6 |
| | Females educ. - primary | 0.5 |
| | Females educ. - secondary | 0.2 |
| | Females educ. - tertiary | 0.1 |
| | Age of head | 51 |
| | Male head of housheold | 97.0% |
| | Males 15-34 | 0.9 |
| | Females 15-34 | 0.9 |
| | Males 35-59 | 0.6 |
| | Females 35-59 | 0.6 |
| | Non-ag wage earner, 1994 | 34.0% |
| | Ag wage earner, 1994 | 16.0% |
| | Self employed, 1994 | 9.7% |
| | HYV seed used, 1994 | 21.9% |
| | Chemicals used, 1994 | 49.2% |
| | Indigenous household | 21.2% |
| *Financial* | Formal credit access, 1994 | 28.8% |
| *Migration* | Migrant network in U.S. | 1.8 |
| | Migrant network in Mexico | 11.0 |
| *Regional* | North | 20.9% |
| | North Pacific | 11.5% |
| | Center | 26.7% |
| | Gulf | 17.0% |
| | South | 24.0% |

**Table 3: Probit results for activity participation**

Number of household = 972

| | Crop Production | | Livestock Production | | Self-employment | | Non-ag Wage Employment | | Ag Wage Employment | | Remittance Income | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* |
| Irrigated land (hectares) | -0.021 | 0.21 | **-0.030** | **0.05** | 0.015 | 0.28 | -0.004 | 0.74 | -0.014 | 0.50 | 0.011 | 0.47 |
| Rainfed land (hectares) | 0.015 | 0.21 | **0.145** | **0.10** | -0.002 | 0.69 | **-0.018** | **0.00** | **-0.021** | **0.01** | **0.018** | **0.00** |
| Pasture land (hectares) | -0.003 | 0.72 | 0.014 | 0.13 | -0.003 | 0.40 | 0.000 | 0.99 | 0.000 | 0.93 | -0.003 | 0.62 |
| Livestock ownership, 1994 | 0.013 | 0.11 | **0.132** | **0.00** | 0.003 | 0.35 | **-0.012** | **0.01** | **-0.018** | **0.02** | **-0.010** | **0.06** |
| Tractor ownership, 1994 | 0.075 | 0.80 | **-0.588** | **0.01** | **-0.352** | **0.07** | -0.256 | 0.18 | -0.238 | 0.36 | -0.257 | 0.30 |
| Truck ownership, 1994 | 0.115 | 0.59 | 0.027 | 0.88 | 0.049 | 0.73 | -0.056 | 0.69 | 0.001 | 1.00 | -0.117 | 0.51 |
| Males educ. - literate | -0.083 | 0.62 | **0.215** | **0.06** | -0.012 | 0.90 | **0.187** | **0.05** | 0.043 | 0.69 | -0.030 | 0.81 |
| Males educ. - primary | -0.114 | 0.55 | 0.179 | 0.15 | -0.001 | 0.99 | **0.203** | **0.06** | -0.068 | 0.58 | 0.031 | 0.83 |
| Males educ. - secondary | -0.100 | 0.64 | 0.127 | 0.36 | 0.087 | 0.47 | **0.229** | **0.06** | -0.024 | 0.86 | **-0.325** | **0.07** |
| Males educ. - tertiary | 0.174 | 0.58 | -0.164 | 0.39 | 0.136 | 0.41 | **0.270** | **0.10** | -0.204 | 0.36 | **-0.474** | **0.09** |
| Females educ. - literate | 0.029 | 0.87 | 0.173 | 0.16 | -0.062 | 0.55 | 0.033 | 0.75 | 0.102 | 0.40 | 0.025 | 0.85 |
| Females educ. - primary | 0.047 | 0.80 | -0.007 | 0.96 | 0.081 | 0.46 | -0.009 | 0.93 | -0.021 | 0.88 | 0.116 | 0.43 |
| Females educ. - secondary | -0.280 | 0.19 | -0.172 | 0.28 | 0.133 | 0.31 | 0.054 | 0.68 | -0.031 | 0.84 | 0.245 | 0.18 |
| Females educ. - tertiary | -0.300 | 0.23 | -0.134 | 0.47 | 0.062 | 0.70 | 0.216 | 0.18 | **-0.591** | **0.03** | -0.147 | 0.56 |
| Age of head | -0.009 | 0.13 | -0.005 | 0.24 | -0.003 | 0.47 | **-0.011** | **0.00** | -0.003 | 0.42 | **0.040** | **0.00** |
| Male head of housheold | -0.177 | 0.64 | 0.350 | 0.21 | -0.008 | 0.98 | -0.175 | 0.52 | -0.305 | 0.33 | 0.069 | 0.86 |
| Males 15-34 | 0.252 | 0.18 | -0.114 | 0.32 | 0.012 | 0.91 | 0.014 | 0.88 | **0.226** | **0.05** | -0.098 | 0.47 |
| Females 15-34 | 0.006 | 0.97 | 0.058 | 0.64 | 0.070 | 0.51 | 0.125 | 0.23 | 0.137 | 0.27 | -0.134 | 0.36 |
| Males 35-59 | **0.356** | **0.04** | -0.058 | 0.63 | 0.120 | 0.26 | 0.132 | 0.20 | 0.157 | 0.19 | 0.028 | 0.85 |
| Females 35-59 | -0.205 | 0.24 | 0.138 | 0.29 | 0.066 | 0.58 | -0.112 | 0.33 | **-0.308** | **0.03** | 0.183 | 0.20 |
| Non-ag wage earner, 1994 | -0.119 | 0.15 | **-0.116** | **0.09** | -0.016 | 0.80 | **0.249** | **0.00** | **-0.146** | **0.06** | -0.102 | 0.28 |
| Ag wage earner, 1994 | **0.351** | **0.03** | -0.019 | 0.85 | -0.120 | 0.22 | -0.091 | 0.32 | **0.318** | **0.00** | **0.357** | **0.00** |
| Self employed, 1994 | 0.147 | 0.49 | -0.183 | 0.17 | **0.610** | **0.00** | -0.044 | 0.71 | 0.098 | 0.47 | -0.034 | 0.86 |
| HYV seed used,1994 | 0.024 | 0.91 | 0.078 | 0.62 | -0.019 | 0.88 | -0.198 | 0.11 | -0.161 | 0.30 | -0.104 | 0.52 |
| Chemicals used, 1994 | **0.525** | **0.00** | 0.139 | 0.27 | -0.075 | 0.46 | 0.021 | 0.83 | -0.128 | 0.28 | -0.014 | 0.92 |
| Indigenous household | **0.574** | **0.06** | **0.392** | **0.02** | 0.026 | 0.84 | 0.079 | 0.53 | 0.057 | 0.71 | **-0.568** | **0.02** |
| Formal credit access, 1994 | 0.137 | 0.42 | 0.130 | 0.31 | 0.015 | 0.89 | 0.008 | 0.94 | 0.015 | 0.91 | -0.104 | 0.47 |
| Migrant network in U.S. | 0.024 | 0.40 | **-0.047** | **0.03** | 0.001 | 0.95 | -0.014 | 0.34 | -0.036 | 0.11 | **0.204** | **0.00** |
| Migrant network in Mexico | 0.007 | 0.65 | 0.006 | 0.57 | 0.006 | 0.47 | 0.010 | 0.20 | 0.015 | 0.12 | 0.002 | 0.89 |
| North | -0.395 | 0.13 | **0.690** | **0.00** | 0.073 | 0.64 | **0.746** | **0.00** | **0.726** | **0.00** | -0.032 | 0.88 |
| North Pacific | **-0.816** | **0.01** | -0.209 | 0.35 | -0.261 | 0.21 | 0.025 | 0.90 | 0.315 | 0.23 | **-0.585** | **0.04** |
| Center | -0.055 | 0.82 | **0.606** | **0.00** | 0.065 | 0.63 | **0.425** | **0.00** | **0.355** | **0.04** | 0.061 | 0.74 |
| Gulf | 0.599 | 0.18 | **1.379** | **0.00** | **0.599** | **0.00** | **0.512** | **0.00** | **0.623** | **0.00** | -0.142 | 0.55 |
| Constant | **1.739** | **0.00** | -0.570 | 0.14 | **-0.909** | **0.01** | -0.332 | 0.35 | **-0.969** | **0.02** | **-3.730** | **0.00** |

Bold indicates significance at least the 90% level.

**Table 4: Selectivity-corrected systems estimates of income equations**

Number of household = 972

| | Crop Production | | Livestock Production | | Self-employment | | Non-ag Wage Employment | | Ag Wage Employment | | Remittance Income | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* |
| Irrigated land (hectares) | **804.0** | **0.00** | **114.0** | **0.01** | **100.1** | **0.00** | -51.5 | 0.50 | 23.6 | 0.35 | **63.2** | **0.05** |
| Rainfed land (hectares) | 1.7 | 0.96 | **48.0** | **0.00** | **32.2** | **0.01** | 23.9 | 0.42 | 3.7 | 0.71 | -0.7 | 0.96 |
| Pasture land (hectares) | -2.4 | 0.93 | 4.2 | 0.68 | 8.9 | 0.32 | -7.8 | 0.68 | -5.4 | 0.40 | -1.2 | 0.88 |
| Livestock ownership, 1994 | -3.5 | 0.90 | **133.6** | **0.00** | 2.0 | 0.84 | 21.5 | 0.39 | 5.3 | 0.56 | 11.1 | 0.28 |
| Tractor ownership, 1994 | **4611.5** | **0.00** | | | | | | | | | | |
| Truck ownership, 1994 | 565.3 | 0.60 | **1018.2** | **0.01** | -259.3 | 0.47 | 538.3 | 0.48 | 112.5 | 0.66 | | |
| Males educ. - literate | 75.2 | 0.92 | -294.2 | 0.34 | -10.8 | 0.97 | 810.6 | 0.18 | 231.2 | 0.23 | -106.9 | 0.66 |
| Males educ. - primary | 616.8 | 0.47 | **-714.5** | **0.04** | 240.0 | 0.42 | **1730.5** | **0.01** | 57.8 | 0.79 | -191.4 | 0.49 |
| Males educ. - secondary | 585.7 | 0.54 | -373.6 | 0.33 | 428.3 | 0.20 | **1245.9** | **0.09** | 45.0 | 0.85 | 30.8 | 0.93 |
| Males educ. - tertiary | **3516.0** | **0.01** | -719.7 | 0.17 | 634.1 | 0.18 | **2627.7** | **0.01** | -98.0 | 0.77 | 204.9 | 0.67 |
| Females educ. - literate | -47.2 | 0.95 | -124.6 | 0.70 | 45.1 | 0.87 | -346.4 | 0.56 | -69.0 | 0.73 | 352.8 | 0.18 |
| Females educ. - primary | 791.1 | 0.36 | **602.7** | **0.08** | 176.6 | 0.56 | -704.5 | 0.27 | -43.7 | 0.84 | 56.4 | 0.84 |
| Females educ. - secondary | 308.5 | 0.78 | 538.5 | 0.20 | **625.3** | **0.09** | -787.5 | 0.31 | -164.5 | 0.52 | -307.1 | 0.37 |
| Females educ. - tertiary | **3596.2** | **0.01** | **987.0** | **0.05** | **896.5** | **0.04** | **1668.7** | **0.08** | 92.5 | 0.80 | **1443.5** | **0.00** |
| Age of head | -18.1 | 0.54 | -1.9 | 0.87 | 4.0 | 0.70 | **41.8** | **0.07** | 10.8 | 0.13 | -29.5 | 0.13 |
| Male head of housheold | -1610.2 | 0.45 | 53.5 | 0.95 | **1333.0** | **0.07** | -1736.7 | 0.27 | **-1134.2** | **0.03** | 607.0 | 0.38 |
| Males 15-34 | -1134.1 | 0.16 | 433.1 | 0.17 | -140.7 | 0.61 | -379.1 | 0.52 | 183.9 | 0.37 | 181.1 | 0.48 |
| Females 15-34 | -910.3 | 0.28 | -516.5 | 0.12 | -85.6 | 0.77 | **1119.0** | **0.07** | 153.4 | 0.46 | 35.8 | 0.90 |
| Males 35-59 | 178.7 | 0.84 | 48.3 | 0.88 | -96.0 | 0.74 | -511.7 | 0.41 | 157.6 | 0.45 | -137.4 | 0.61 |
| Females 35-59 | 768.9 | 0.40 | **-674.9** | **0.06** | -14.0 | 0.96 | 646.9 | 0.33 | -220.3 | 0.35 | 25.2 | 0.93 |
| Non-ag wage earner, 1994 | | | | | | | 532.5 | 0.18 | | | | |
| Ag wage earner, 1994 | | | | | | | 249.4 | 0.64 | 190.2 | 0.19 | | |
| Self employed, 1994 | | | | | **2453.5** | **0.00** | | | | | | |
| HYV seed used,1994 | 1081.6 | 0.25 | 352.3 | 0.35 | | | | | | | | |
| Chemicals used, 1994 | 306.1 | 0.72 | 433.1 | 0.15 | | | | | | | | |
| Indigenous household | -1008.6 | 0.31 | 356.4 | 0.34 | -192.3 | 0.57 | **-1628.6** | **0.02** | -197.3 | 0.39 | 463.4 | 0.25 |
| Formal credit access, 1994 | -498.4 | 0.53 | -77.0 | 0.81 | -320.9 | 0.25 | 71.7 | 0.90 | -96.0 | 0.63 | -307.9 | 0.25 |
| Migrant network in U.S. | | | | | | | | | | | -4.8 | 0.95 |
| Migrant network in Mexico | | | | | | | | | | | -15.4 | 0.46 |
| Inverse Mills Ratio | **-8422.3** | **0.03** | **-2119.8** | **0.00** | -138.0 | 0.83 | **-3232.4** | **0.01** | **-679.9** | **0.03** | **-1382.0** | **0.01** |
| Constant | 4954.4 | 0.07 | **1865.4** | **0.10** | -1002.9 | 0.44 | 3116.4 | 0.16 | **1827.9** | **0.02** | **4184.4** | **0.05** |

Bold indicates significance at least the 90% level.

**Table 5: Social and public capital variables**

| Number of household = 972 | **Mean or percentage** |
|---|---|
| Kilometers to health center | 8.8 |
| Kilometers to post office | 19.7 |
| Kilometers to telegraph | 27.8 |
| Kilometers to fax machine | 27.4 |
| Time to nearest urban center (hours) | 53.6 |
| Distance to nearest urban center (hours) | 25.2 |
| Number of rural centers within 1 hour | 2.6 |
| Number of urban centers within 1 hour | 1.6 |
| Share of roads that are paved | 50.7% |
| Ejido has a DICONSA store | 50.3% |
| Ejido has a meeting room | 49.7% |
| Ejido has public lighting | 74.7% |
| Ejido has a secondary school | 45.7% |
| Ejido has a high school | 7.3% |
| Household has access to LICONSA store | 18.6% |
| Household has access to emergency work | 11.0% |
| *Household water access* | |
| No piped water access | 34.7% |
| Access to piped water outside the house | 14.8% |
| Access to piped water inside the hoouse | 50.5% |
| *Household sewage access* | |
| No sewage system access | 43.8% |
| Access to whole in the ground | 9.6% |
| Access to septic system | 33.9% |
| Access to a piped sewage system | 12.8% |
| *Household latrine/bathroom access* | |
| No access to latrine or bathroom | 23.6% |
| Access to a latrine | 43.5% |
| Access to a bathroom | 32.9% |
| Household has access to electricity | 87.7% |
| *Household telephone access* | |
| No telephone access | 41.1% |
| Access to a public phone | 53.6% |
| Access to a phone at home | 5.4% |
| Ejido belongs to aric | 3.1% |
| Ejido belongs to a ejido union | 23.4% |
| Ejido belongs to a campesino organization | 72.1% |
| *Stage of PROCEDE reform* | |
| Not intitiated | 35.1% |
| In process | 17.3% |
| Completed | 47.6% |
| Household participates in family project | 2.9% |
| Household participates in production organization | 11.3% |
| Household participates in irrigation project | 4.3% |
| Household participates in UAIM | 2.3% |
| Household participates in other formal organization | 7.6% |
| Household participates in informal organization | 16.4% |
| Household is in a production contract | 6.2% |
| Household receives technical assistance | 14.9% |
| Share of households speaking indigenous language | 20.8% |
| Ejido has environmental problems | 44.5% |
| *Frequency of household particpation in assemblies* | |
| Rarely/never particpate | 4.2% |
| Sometimes participate | 16.6% |
| Always participate | 79.2% |
| *Degree of household respect for community agreements* | |
| Rarely/never respect agreements | 5.5% |
| Sometimes respect agreements | 20.8% |
| Always respect agreements | 73.8% |
| Household agrees with use of common lands | 72.6% |
| Communal lands per capita (hectares) | 25.2 |
| Total ejido population | 200.9 |

**Table 6: Factor analysis**

Number of household = 972

| **Social and public capital variables** | ***Factor 1*** Proximity | ***Factor 2*** Ejido size | ***Factor 3*** Semi-urban | ***Factor 4*** Cooperation | ***Factor 5*** Lack formal arrangements | ***Factor 6*** Household access | ***Factor 7*** Infrastructure | ***Factor 8*** Formal organization |
|---|---|---|---|---|---|---|---|---|
| Kilometers to health center | -0.45 | -0.27 | | | | | | |
| Kilometers to post office | -0.84 | -0.25 | | | | | | |
| Kilometers to telegraph | -0.80 | | | | | | | |
| Kilometers to fax machine | -0.88 | | | | | | | |
| Time to nearest urban center (hours) | -0.76 | | -0.26 | | | | | |
| Distance to nearest urban center (hours) | -0.84 | | | | | | | |
| Number of rural centers within 1 hour | | | 0.35 | | | | | |
| Number of urban centers within 1 hour | | | 0.62 | | | | | |
| Share of roads that are paved | | | 0.25 | | | | 0.48 | 0.28 |
| Ejido has a DICONSA store | | 0.28 | 0.34 | | -0.29 | | | |
| Ejido has a meeting room | | 0.41 | 0.43 | | | | | |
| Ejido has public lighting | | | | | | | 0.71 | |
| Ejido has a secondary school | | 0.49 | 0.31 | | | 0.27 | | -0.32 |
| Ejido has a high school | | 0.70 | | | | | | |
| Household has access to LICONSA store | | 0.35 | | | | | | |
| Household has access to emergency work | | | | | | | | 0.41 |
| Household water access | | | | | | 0.46 | 0.35 | |
| Household sewage access | | | | | | 0.75 | | |
| Household latrine/bathroom access | | | | | | 0.72 | | |
| Household has access to electricity | | | | | | | 0.66 | |
| Household telephone access | | 0.28 | 0.31 | | | 0.48 | | |
| Ejido belongs to aric | | | | | -0.63 | | | |
| Ejido belongs to an ejido union | | | | | | | 0.33 | 0.33 |
| Ejido belongs to a campesino organization | 0.25 | | | | | | | 0.59 |
| Stage of PROCEDE reform | | -0.29 | 0.49 | | | | | |
| Household participates in family project | | | | | | | | |
| Household participates in production org | | | | | | | | 0.36 |
| Household participates in irrigation project | | | | | | | | |
| Household participates in UAIM | | | | | | | | |
| Household participates in other formal org | | | | | -0.54 | | | |
| Household participates in informal org | | | 0.29 | 0.40 | | | -0.30 | |
| Household is in a production contract | | | | | -0.48 | | | |
| Household receives technical assistance | | | | | -0.48 | | | |
| Share of HHs speaking indigenous language | -0.39 | 0.32 | | | | -0.30 | | |
| Ejido has environmental problems | | 0.42 | | | | -0.26 | | |
| Frequency of HH participation in assemblies | | | | 0.72 | | | | |
| Household respect for community agreements | | | | 0.71 | | | | |
| Household agrees with use of common lands | | | | | 0.41 | | | |
| Communal lands per capita (hectares) | -0.37 | | | | | | | 0.32 |
| Total ejido population | | 0.65 | | | | | | |
| Eigenvalues | 5.26 | 2.81 | 2.23 | 1.77 | 1.57 | 1.46 | 1.33 | 1.28 |
| Proportion of variance | 13.2% | 7.0% | 5.6% | 4.4% | 3.9% | 3.7% | 3.3% | 3.2% |

**Table 7: Probit results for activity participation with social and public capital factors**

Number of household = 972

| | Crop Production | | Livestock Production | | Self-employment | | Non-ag Wage Employment | | Ag Wage Employment | | Remittance Income | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* |
| Irrigated land (hectares) | -0.011 | 0.55 | **-0.028** | **0.07** | 0.010 | 0.48 | -0.001 | 0.91 | -0.008 | 0.69 | 0.015 | 0.36 |
| Rainfed land (hectares) | 0.013 | 0.28 | *0.013* | *0.13* | -0.001 | 0.86 | **-0.018** | **0.00** | **-0.024** | **0.01** | **0.018** | **0.01** |
| Pasture land (hectares) | -0.002 | 0.78 | 0.013 | 0.16 | -0.003 | 0.38 | 0.000 | 0.98 | 0.000 | 0.92 | -0.004 | 0.48 |
| Livestock ownership, 1994 | 0.012 | 0.12 | **0.128** | **0.00** | 0.004 | 0.30 | **-0.011** | **0.01** | **-0.018** | **0.02** | **-0.012** | **0.02** |
| Tractor ownership, 1994 | 0.111 | 0.71 | **-0.521** | **0.03** | **-0.391** | **0.05** | -0.212 | 0.27 | -0.135 | 0.61 | -0.123 | 0.63 |
| Truck ownership, 1994 | 0.177 | 0.43 | 0.045 | 0.80 | 0.002 | 0.99 | -0.083 | 0.55 | 0.012 | 0.95 | -0.157 | 0.39 |
| Males educ. - literate | -0.128 | 0.46 | **0.213** | **0.06** | -0.029 | 0.77 | **0.182** | **0.07** | 0.049 | 0.66 | -0.047 | 0.71 |
| Males educ. - primary | -0.111 | 0.58 | 0.204 | 0.11 | -0.032 | 0.77 | **0.200** | **0.07** | -0.052 | 0.67 | 0.049 | 0.74 |
| Males educ. - secondary | -0.076 | 0.74 | 0.177 | 0.22 | 0.035 | 0.77 | **0.231** | **0.07** | 0.033 | 0.82 | **-0.353** | **0.06** |
| Males educ. - tertiary | 0.205 | 0.53 | -0.091 | 0.64 | 0.044 | 0.79 | **0.288** | **0.09** | -0.067 | 0.77 | **-0.479** | **0.10** |
| Females educ. - literate | 0.030 | 0.87 | 0.177 | 0.16 | -0.057 | 0.59 | 0.043 | 0.68 | 0.111 | 0.36 | 0.033 | 0.82 |
| Females educ. - primary | 0.047 | 0.82 | 0.006 | 0.96 | 0.049 | 0.66 | -0.031 | 0.78 | 0.010 | 0.94 | 0.092 | 0.55 |
| Females educ. - secondary | -0.287 | 0.20 | -0.141 | 0.39 | 0.087 | 0.52 | 0.046 | 0.73 | 0.019 | 0.91 | 0.263 | 0.16 |
| Females educ. - tertiary | -0.330 | 0.21 | -0.081 | 0.68 | -0.005 | 0.98 | 0.191 | 0.24 | **-0.531** | **0.07** | -0.129 | 0.62 |
| Age of head | -0.006 | 0.31 | -0.004 | 0.35 | -0.003 | 0.40 | **-0.010** | **0.01** | -0.001 | 0.80 | **0.043** | **0.00** |
| Male head of housheold | -0.238 | 0.55 | 0.281 | 0.32 | 0.006 | 0.98 | -0.223 | 0.42 | -0.338 | 0.29 | 0.101 | 0.80 |
| Males 15-34 | 0.251 | 0.20 | -0.156 | 0.19 | 0.049 | 0.63 | 0.021 | 0.84 | **0.206** | **0.07** | -0.095 | 0.49 |
| Females 15-34 | 0.024 | 0.90 | 0.063 | 0.62 | 0.091 | 0.40 | 0.136 | 0.20 | 0.120 | 0.34 | -0.131 | 0.39 |
| Males 35-59 | **0.404** | **0.02** | -0.072 | 0.55 | 0.148 | 0.17 | 0.141 | 0.17 | 0.147 | 0.23 | 0.030 | 0.84 |
| Females 35-59 | -0.194 | 0.28 | 0.156 | 0.24 | 0.078 | 0.51 | -0.105 | 0.36 | **-0.324** | **0.02** | 0.178 | 0.24 |
| Non-ag wage earner, 1994 | -0.099 | 0.25 | *-0.087* | *0.21* | -0.031 | 0.62 | **0.252** | **0.00** | **-0.135** | **0.09** | -0.058 | 0.55 |
| Ag wage earner, 1994 | **0.335** | **0.04** | -0.037 | 0.72 | -0.101 | 0.31 | -0.096 | 0.30 | **0.311** | **0.00** | **0.361** | **0.00** |
| Self employed, 1994 | 0.199 | 0.39 | -0.168 | 0.21 | **0.611** | **0.00** | -0.043 | 0.72 | 0.103 | 0.46 | -0.083 | 0.68 |
| HYV seed used,1994 | 0.033 | 0.88 | 0.073 | 0.65 | -0.079 | 0.54 | ***-0.241*** | ***0.06*** | -0.144 | 0.37 | -0.068 | 0.69 |
| Chemicals used, 1994 | **0.585** | **0.00** | 0.149 | 0.25 | -0.099 | 0.35 | 0.044 | 0.67 | -0.096 | 0.44 | 0.071 | 0.62 |
| Indigenous household | *0.397* | *0.22* | **0.414** | **0.03** | 0.079 | 0.59 | -0.002 | 0.99 | -0.094 | 0.58 | **-0.735** | **0.01** |
| Formal credit access, 1994 | 0.173 | 0.32 | 0.127 | 0.33 | -0.038 | 0.72 | -0.031 | 0.77 | 0.031 | 0.81 | -0.134 | 0.38 |
| Migrant network in U.S. | 0.030 | 0.30 | **-0.044** | **0.04** | -0.003 | 0.87 | -0.011 | 0.47 | -0.034 | 0.14 | **0.212** | **0.00** |
| Migrant network in Mexico | 0.006 | 0.69 | 0.004 | 0.72 | 0.004 | 0.61 | 0.009 | 0.29 | 0.014 | 0.16 | 0.003 | 0.82 |
| North | ***-0.547*** | ***0.09*** | **0.523** | **0.02** | -0.124 | 0.52 | **0.543** | **0.00** | **0.696** | **0.00** | 0.014 | 0.96 |
| North Pacific | **-0.866** | **0.01** | -0.290 | 0.23 | ***-0.392*** | ***0.08*** | -0.064 | 0.77 | 0.380 | 0.18 | **-0.587** | **0.05** |
| Center | -0.027 | 0.92 | **0.552** | **0.00** | -0.054 | 0.72 | **0.339** | **0.02** | **0.346** | **0.08** | 0.199 | 0.32 |
| Gulf | 0.683 | 0.19 | **1.280** | **0.00** | **0.384** | **0.04** | *0.193* | *0.31* | **0.405** | **0.09** | -0.119 | 0.70 |
| F1 - Proximity | -0.059 | 0.57 | -0.047 | 0.52 | 0.001 | 0.99 | -0.046 | 0.40 | **-0.111** | **0.08** | **-0.158** | **0.07** |
| F2 - Ejido size | 0.119 | 0.21 | **-0.138** | **0.02** | -0.002 | 0.97 | 0.050 | 0.30 | -0.056 | 0.35 | 0.073 | 0.32 |
| F3 - Semi-urban | -0.131 | 0.18 | -0.061 | 0.36 | **0.115** | **0.03** | **0.099** | **0.06** | 0.042 | 0.53 | **-0.139** | **0.09** |
| F4 - Cooperation | 0.064 | 0.41 | 0.071 | 0.22 | -0.040 | 0.42 | 0.022 | 0.64 | 0.087 | 0.14 | 0.057 | 0.41 |
| F5 - Lack formal arrangements | 0.062 | 0.45 | 0.044 | 0.49 | -0.029 | 0.59 | 0.025 | 0.63 | 0.080 | 0.28 | -0.025 | 0.74 |
| F6 - Household access | -0.059 | 0.55 | -0.021 | 0.76 | **0.163** | **0.00** | -0.023 | 0.67 | **-0.204** | **0.00** | 0.123 | 0.12 |
| F7 - Infrastructure | -0.068 | 0.48 | -0.028 | 0.67 | 0.001 | 0.98 | -0.026 | 0.61 | 0.015 | 0.80 | **-0.137** | **0.07** |
| F8 - Formal organization | **0.186** | **0.03** | **0.150** | **0.02** | 0.064 | 0.21 | **0.156** | **0.00** | 0.073 | 0.22 | **-0.191** | **0.01** |
| Constant | **1.684** | **0.00** | -0.470 | 0.26 | **-0.703** | **0.06** | -0.165 | 0.65 | **-1.062** | **0.02** | **-4.080** | **0.00** |

Bold indicates significance at least the 90% level.

Italics indicates significance differs from Table 3.

**Table 8: Selectivity-corrected systems estimates of income equations with social and public capital factors**

Number of household = 972

| | Crop Production | | Livestock Production | | Self-employment | | Non-ag Wage Employment | | Ag Wage Employment | | Remittance Income | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* | *Coef* | *P-value* |
| Irrigated land (hectares) | **780.8** | **0.00** | **103.6** | **0.02** | **74.7** | **0.04** | -62.6 | 0.43 | 19.5 | 0.45 | **55.9** | **0.09** |
| Rainfed land (hectares) | 22.2 | 0.55 | **52.2** | **0.00** | **35.3** | **0.01** | 49.6 | 0.15 | 11.8 | 0.31 | 3.5 | 0.79 |
| Pasture land (hectares) | 1.8 | 0.95 | 5.7 | 0.58 | 9.5 | 0.30 | -1.3 | 0.95 | -4.5 | 0.49 | -2.2 | 0.79 |
| Livestock ownership, 1994 | -12.7 | 0.66 | **126.0** | **0.00** | 0.7 | 0.95 | 36.1 | 0.18 | 11.4 | 0.26 | 8.2 | 0.43 |
| Tractor ownership, 1994 | **4253.6** | **0.00** | | | | | | | | | | |
| Truck ownership, 1994 | 308.9 | 0.77 | **875.6** | **0.03** | -314.4 | 0.40 | 330.4 | 0.67 | 143.0 | 0.58 | | |
| Males educ. - literate | 147.6 | 0.85 | -352.9 | 0.25 | -25.6 | 0.92 | 656.4 | 0.28 | 218.3 | 0.26 | -132.6 | 0.59 |
| Males educ. - primary | 495.0 | 0.56 | **-870.0** | **0.01** | 158.4 | 0.60 | **1528.3** | **0.02** | 55.1 | 0.80 | -226.9 | 0.41 |
| Males educ. - secondary | 382.9 | 0.69 | ***-654.7*** | ***0.09*** | 214.8 | 0.53 | *786.3* | *0.31* | -15.6 | 0.95 | -65.2 | 0.85 |
| Males educ. - tertiary | **2958.4** | **0.03** | ***-1072.0*** | ***0.04*** | 336.8 | 0.47 | **2002.5** | **0.05** | -129.2 | 0.70 | 60.2 | 0.90 |
| Females educ. - literate | 24.6 | 0.98 | -180.4 | 0.57 | 49.0 | 0.86 | -508.7 | 0.40 | -119.0 | 0.56 | 356.5 | 0.17 |
| Females educ. - primary | 790.0 | 0.37 | *539.6* | *0.12* | 113.3 | 0.71 | -842.4 | 0.19 | -67.3 | 0.76 | 91.7 | 0.75 |
| Females educ. - secondary | 347.4 | 0.75 | 327.2 | 0.43 | *442.2* | *0.23* | -1200.1 | 0.13 | -230.9 | 0.38 | -234.9 | 0.50 |
| Females educ. - tertiary | **3370.4** | **0.01** | *709.6* | *0.16* | *682.6* | *0.13* | 1139.5 | 0.24 | 205.9 | 0.58 | **1365.0** | **0.00** |
| Age of head | -37.8 | 0.20 | -8.8 | 0.45 | 0.8 | 0.94 | **44.1** | **0.07** | 9.2 | 0.20 | -19.2 | 0.32 |
| Male head of housheold | -1047.7 | 0.62 | 285.9 | 0.74 | **1560.7** | **0.04** | -1237.4 | 0.44 | **-998.5** | **0.07** | 534.8 | 0.44 |
| Males 15-34 | -1071.2 | 0.18 | ***603.3*** | ***0.06*** | -21.4 | 0.94 | -350.2 | 0.55 | 151.5 | 0.47 | 190.8 | 0.46 |
| Females 15-34 | -871.0 | 0.30 | -454.3 | 0.17 | -62.9 | 0.84 | **1165.3** | **0.07** | 136.2 | 0.52 | -6.3 | 0.98 |
| Males 35-59 | 72.2 | 0.93 | 82.7 | 0.80 | -102.4 | 0.73 | -714.9 | 0.26 | 100.7 | 0.63 | -81.5 | 0.76 |
| Females 35-59 | 876.6 | 0.33 | **-659.6** | **0.06** | -26.7 | 0.93 | 961.9 | 0.15 | -116.3 | 0.65 | 39.8 | 0.89 |
| Non-ag wage earner, 1994 | | | | | | | 258.8 | 0.56 | | | | |
| Ag wage earner, 1994 | | | | | | | 337.9 | 0.52 | 137.7 | 0.38 | | |
| Self employed, 1994 | | | | | **2278.8** | **0.00** | | | | | | |
| HYV seed used,1994 | 765.9 | 0.43 | 239.5 | 0.53 | | | | | | | | |
| Chemicals used, 1994 | 18.4 | 0.98 | 149.2 | 0.64 | | | | | | | | |
| Indigenous household | 1217.2 | 0.28 | 708.4 | 0.11 | -34.0 | 0.93 | **-1646.0** | **0.05** | -316.0 | 0.26 | 602.3 | 0.21 |
| Formal credit access, 1994 | -672.4 | 0.41 | -190.5 | 0.55 | -395.9 | 0.17 | 83.4 | 0.89 | -93.1 | 0.65 | -332.1 | 0.22 |
| Migrant network in U.S. | | | | | | | | | | | 34.9 | 0.66 |
| Migrant network in Mexico | | | | | | | | | | | -17.8 | 0.40 |
| F1 - Proximity | **1187.9** | **0.01** | 297.2 | 0.07 | 154.5 | 0.29 | 158.3 | 0.61 | 71.4 | 0.53 | -22.4 | 0.87 |
| F2 - Ejido size | -508.3 | 0.19 | 105.6 | 0.50 | 96.4 | 0.47 | -0.2 | 1.00 | 87.6 | 0.38 | -103.3 | 0.41 |
| F3 - Semi-urban | **-715.5** | **0.05** | 122.7 | 0.40 | 156.0 | 0.32 | -250.6 | 0.41 | 70.9 | 0.44 | **222.8** | **0.09** |
| F4 - Cooperation | -411.8 | 0.27 | -231.3 | 0.12 | -105.2 | 0.41 | -90.7 | 0.74 | 53.5 | 0.58 | -59.0 | 0.62 |
| F5 - Lack formal arrangements | **-635.8** | **0.10** | **-322.2** | **0.04** | **-252.5** | **0.05** | -106.1 | 0.73 | -52.7 | 0.61 | 66.5 | 0.57 |
| F6 - Household access | **1112.4** | **0.01** | **600.7** | **0.00** | **302.1** | **0.07** | **631.3** | **0.04** | 17.8 | 0.88 | 24.6 | 0.86 |
| F7 - Infrastructure | -509.0 | 0.17 | 190.5 | 0.20 | 120.2 | 0.35 | **783.5** | **0.01** | **186.1** | **0.05** | -87.9 | 0.49 |
| F8 - Formal organization | -196.0 | 0.59 | **-277.4** | **0.06** | -198.9 | 0.12 | -195.2 | 0.57 | -104.7 | 0.30 | 3.3 | 0.98 |
| Inverse Mills Ratio | **-9549.9** | **0.01** | **-2768.0** | **0.00** | -487.1 | 0.53 | **-4731.4** | **0.01** | **-978.3** | **0.02** | **-1045.3** | **0.02** |
| Constant | **5352.1** | **0.05** | **2597.3** | **0.02** | -458.6 | 0.74 | **4476.5** | **0.06** | **2330.9** | **0.01** | 3115.9 | 0.14 |

Bold indicates significance at least the 90% level.

Italics indicates significance differs from Table 4.