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# Measuring the poverty reduction potential of land in rural Mexico

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**Abstract**

To help inform the current debate on the role of land as an instrument for poverty reduction, we analyze the conditions under which access to land reduces poverty in Mexican rural communities. Semi-parametric regression results show that access to even a small plot of land can raise household welfare significantly. For smallholders, an additional hectare of land increases welfare on average by 1.3 times the earnings of an agricultural worker. In addition, the marginal welfare value of land depends importantly on a household's control over complementary assets such as education and on the context where assets are used such as road access.


*JEL classification:* O12; Q15; C14
*Keywords:* Land; Household welfare; Semi-parametric estimation

## 1. Introduction

Access to land has for many years been advocated as one of the potentially most effective approaches to rural poverty reduction (Warriner, 1969; Thiesenheusen, 1989; Dorner, 1992; Binswanger et al., 1995). This can be seen in the extensive and sometimes dramatic land reform programs that have occurred in numerous countries around the world, and in particular in Latin America (de Janvry, 1981). Justification for these

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programs is based on the assumption that land has a strong welfare generating potential for beneficiaries. Yet, land reform programs have frequently met with limited success in reducing poverty, and a number of recent empirical studies have called into question the importance of land as a poverty-reducing instrument (López and Valdés, 2000a). There is, however, a remarkable absence of solid empirical evidence measuring the potential of land in reducing poverty, particularly carefully taking into account the specific conditions under which land is used by beneficiaries, when we well know that these conditions are key determinants of success or failure.

There is little doubt that land is a source of income, based on the empirical evidence provided by numerous studies that have documented the existence of a positive association between land and incomes (see for example Scott, 2000 for Chile; Gunning et al., 2000 for Zimbabwe; Grootaert et al., 1997 for Côte d'Ivoire; Bouis and Haddad, 1990 for the Philippines; and Carter and May, 1999 for South Africa). However, in many cases, this positive association actually translates into small income gains for the range of land endowments provided by land reform programs. For instance, McCulloch and Baulch (2000) simulated the impact of a policy giving 2 ha of land to households in rural Pakistan with less than this amount to find that it has virtually no effect on income poverty. López and Valdés (2000b) and their co-authors find in empirical studies for eight Latin American countries that the income generating potential of land is also quite small. For example, their estimates of income to land elasticities suggest that landholdings in rural areas of Colombia would have to quadruple in order for the poorest 40% of farm households to reach just the poverty line. This led them to recommend looking into approaches other than access to land in order to attack rural poverty.

Although methodologies vary across studies, the empirical literature has in general ignored three important considerations when measuring the marginal poverty-reducing value of land. First, previous studies often assumed a linear specification for the estimation of an income equation. This assumption can be overly restrictive when constraints on a household's ability to effectively use its assets create a complex nonlinear relationship between land endowments and income. In this paper, we use nonparametric techniques to overcome this difficulty. Second, poverty is multidimensional, and an income representation of poverty is both very noisy and overly restrictive as a measure of household welfare. We consequently define an alternative welfare indicator that captures the multidimensionality of poverty as advocated in recent poverty studies (World Bank, 2001). Finally, differences across households in their vital characteristics, their overall asset positions, and their contextual circumstances demonstrate that return to land for them is significantly affected by these conditions. In measuring the return to land, it is consequently important to account for the high degree of heterogeneity across rural households and to use this to make conditional – as opposed to the usual absolute – statements about the poverty-reducing value of land.

In recent years, programs of access to land have returned high on the agenda of poverty reducing strategies pursued by governments, NGOs, and international development agencies (Deininger and Feder, 2002). This has led to large scale initiatives in countries such as Brazil (Cedula da Terra and INCRA) and Colombia (land market assisted reform), and to new initiatives in Mexico (Procede), Honduras (Land Bank), and Bolivia (validation of titles). Measuring the poverty reducing value of land and the conditions for successful use of this instrument has thus become all the more urgent. Additionally, this has to be done from a household (as opposed to a farm) perspective, where beneficiaries may engage in off-farm activities (Reardon et al., 2001; de Janvry and Sadoulet, 2001), and where access to even a small amount of land, given labor market failures, may provide an effective platform for livelihood strategies that allow to move out of poverty, something that was not considered in typical farm-oriented land reforms that only considered on-farm agricultural activities.

Since we are interested in measuring how land can reduce poverty in contexts of extensive rural poverty, we use the household data collected in 1997 by the Mexican Program for Education, Health, and Nutrition (PROGRESA) in poor rural communities. Results show that a small amount of land can create large income gains as it permits to mobilize family labor affected by labor market failures. In general, land has a high but decreasing marginal return for endowments of less than 3 ha and a constant return for land sizes larger than 3 ha. These results are consistent with the theory that small landowners with low opportunity costs of labor exhibit a higher reservation price for land (see Carter and Mesbah, 1993; Carter and May, 1999). Additionally, the marginal welfare value of land depends crucially on both the complementary assets (such as education) and the contextual settings (such as infrastructure) of the poor, prohibiting any absolute statement about the poverty reduction value of land. We also find that ethnicity is an important negative social asset as the marginal value of land for non-indigenous households is on average twice as high as it is for indigenous households. When complementary assets and a favorable context are in place, access to even a small amount of land can help households escape poverty. The paper thus helps establish the complex set of conditions under which land can be a valuable poverty-reducing instrument. The paper does not simulate a land *redistribution* program, that would entail defining how much total land would be distributed to near landless farmers and where it would come from (Ravallion and Sen, 1994). The sole purpose of the paper is to analyze the heterogeneity in marginal returns to land for poor households endowed with little land.

The rest of the paper is outlined as follows. Section 2 derives our estimative income equation from a microeconomic household model for conditions that imply a nonlinear relationship between welfare and land. In Section 3, we explain the semiparametric estimation of the income equation. The data are described in Section 4, including a discussion on our welfare measure and the structure of landholdings in Mexico. The empirical results follow in Section 5, and we conclude the paper in Section 6.

## 2. Theoretical framework: derivation of the income equation

In this section we derive the specification of our income equation from a standard agrarian household production model. We consider a situation of multiple market imperfections to investigate how these distortions affect the economic return to land.

The theoretical framework borrows from the work of Carter and Mesbah (1993) and it assumes three important frictions: 1) Land transactions are ignored and access to land is treated as exogenous, 2) households face the possibility of off-farm unemployment, and 3) access to credit increases with land size.

Under these assumptions, consider a household that generates income by cultivating agricultural land, in addition to possibly supplying labor at an exogenously determined market wage, $w$. The household is endowed with $T$ hectares of land and $\bar{L}$ hours of labor per year that are employed in on-farm agricultural work ($L_f$) and/or off-farm activities ($L_s$). The household cultivates a single crop using $X$ units of input purchased at a per unit market price of $q$. The crop can be sold at an exogenous market price $p$. Let $F(L_f,X,T;z)$ be the production function, where $z$ represents the set of household and contextual characteristics that affect the return on productive assets. Let $\Omega(L_s)$ denote the number of days employed as a function of labor supplied, $L_s$, where $\Omega'>0$, $\Omega''\leq 0$. Let $\Gamma(T)$ denote the amount of working capital available at an interest rate $i$ to a household with land endowment, $T$. The cost of production, $qX$, must be financed by the sum of initial wealth $K$, wage income $w\Omega(L_s)$, and available capital $\Gamma(T)$.

Formally, the household chooses time allocation and purchased inputs to maximize its income:

$$\begin{aligned}
&\max_{L_s,L_f,X}\; pF(L_f,X,T;z) - qX + w\Omega(L_s) - i(qX - K - w\Omega(L_s)) \\
&\text{s.t.} \\
&L_s + L_f \leq \bar{L} && (a) \\
&qX \leq K + w\Omega(L_s) + \Gamma(T) && (b) \\
&L_s \geq 0, L_f \geq 0. && (c)
\end{aligned} \tag{1}$$

Assuming an interior solution for the labor allocation, the first-order conditions of this maximization problem can be written:

$$\begin{aligned}
&pF_L = w(1+i+\lambda)\Omega' \\
&pF_X = q(1+i+\lambda) \\
&\lambda(K + w\Omega(L_s) + \Gamma(T) - qX) = 0; \lambda\geq 0; K + w\Omega(L_s) + \Gamma(T) - qX \geq 0
\end{aligned} \tag{2}$$

where $\lambda$ is the Lagrange multiplier associated with the liquidity constraint (1b).

If (*) denotes solution values of the choice variables that maximize the program above, then the income equation associated with income maximizing behavior can be specified as follows,

$$\begin{aligned}
Y &= pF(L_f^*, X^*, T; z) - q(1+i)X^* + w(1+i)\Omega(L_s^*) + iK \\
&= \Lambda(p,q,i,w,\bar{L},K,T,z).
\end{aligned} \tag{3}$$

The income equation is a function of prices, household's endowment of productive assets, and any characteristic that affects the return to these assets. We can differentiate Eq. (3) to see how an increase in landholdings affects household income,

$$\begin{aligned}
\frac{\mathrm{d}Y}{\mathrm{d}T} &= pF_T + (pF_L - w(1+i)\Omega')\frac{\mathrm{d}L_f^*}{\mathrm{d}T} + (pF_X - q(1+i))\frac{\mathrm{d}X^*}{\mathrm{d}T} \\
&= pF_T + \lambda w\Omega'\frac{\mathrm{d}L_f^*}{\mathrm{d}T} + \lambda q\frac{\mathrm{d}X^*}{\mathrm{d}T}.
\end{aligned} \tag{4}$$

If capital markets are perfect ($\lambda$=0), then the terms in parentheses are identically equal to zero and the marginal value of land is simply the value of its marginal product, i.e., $dY/dT=pF_T$. Moreover, if households face the same opportunity costs of labor and inputs, and we assume constant returns to scale, then the marginal return to land is constant for all land endowments.

Conversely, with imperfections in labor and credit markets, the terms in parentheses are positive. An increase in landholding has both a direct and an indirect effect on income. In addition to directly increasing production, more land affects the distortions in the allocation of production inputs. As the land endowment increases, labor allocated to the farm increases, the under-employment rate $\Omega$ decreases, and the marginal productivity of labor $\Omega'$ increases. On the other hand, as the land endowment increases, the credit constraint may either tighten or loosen ($\lambda$ can increase or decrease) depending on the relative increase in credit availability $\Gamma(T)$ and on the demand for inputs. For instance, in poor rural areas characterized by thin labor markets, an increase in household land will increase the marginal product value of household labor and reduce the difference between its shadow wage and the market wage. If, as Eswaran and Kotwal (1986) suggest, larger farms have better access to credit, then an increase in landholding will increase the use of variable inputs and reduce the distortion in the input markets as well. With market distortions, we consequently expect the marginal value of land to vary with the land endowment, and quite possibly in a nonlinear manner.

For better insight into how imperfections in the land, labor, and credit markets affect the land's potential to generate income, we simulate in Fig. 1 the model above with specific functional forms and a rough parameterization, given our data.[1]

The top panel displays the relationship between income and land for both perfect and imperfect markets. When markets are perfect, landless households must work entirely off-farm and earn a monthly income of 1280 pesos. With access to a hectare of land, household income will increase by the marginal value of land, 228 pesos, as the household adjusts its labor allocation between working its land and off-farm employment. In the presence of market imperfections, the mapping of land to income shifts downward and is no longer linear. The curve intercepts the $y$-axis at 768 pesos: the expected wage rate when faced with possible unemployment. With distortions in the labor market, the marginal value of land is high for small farmers since another plot of land will also increase their shadow wage. As land endowments increase and the household can allocate its labor more effectively, the marginal return to land declines. Around 4 ha, as access to credit improves, the marginal value of land begins to increase. A household's inability to generate sufficient economic livelihood depends not only on its land endowment but also on its ability to effectively utilize the amount of land it does possess.

[1] We use a Cobb–Douglas production function $F(\cdot)=L_f^{1/3}X^{1/3}T^{1/3}$, unemployment characterized by $\Omega(L_s)=L_s-0.4*L_s^2$, and credit availability by $\Gamma(T)=1300*\Phi(T-10/3)$. We take $p$=1500 pesos/metric ton of corn, the average wage for a nonagricultural worker $w$=1280 pesos per month, the average per unit cost of corn production $q$=460 pesos per month, and the interest rate $i$=0.05.

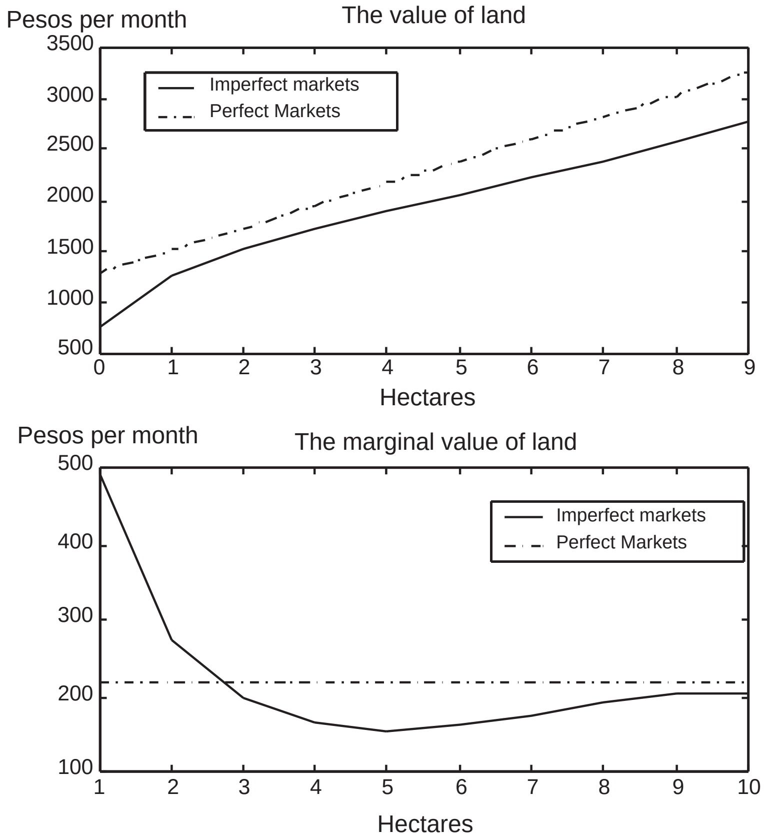


Fig. 1. The income value of land under market imperfections.

To estimate the marginal value of land, as depicted in Fig. 1, the typical linear approximation to an income equation is an inadequate specification. Without knowing what are the underlying frictions of our environment, and hence the shape of the relationship between land and income, we relax completely the functional form for land and explore this mapping with nonparametric estimation techniques.

## 3. Econometric specification of the income equation

This section outlines the semiparametric procedure for estimating the relationship between income and land endowments. Our production model implies that any characteristic that affects the return to the productive assets of the household should influence the household's income. This list includes household demographics, constraints on factor use, as well as village and regional factors that capture employment opportunities and market integration. Although a fully nonparametric specification of the income equation would best capture its underlying shape, with several possible covariates the computation cost of this technique is prohibitively high.[2] A semiparametric procedure allows us to relax the functional form on land and still control for the other factors that determine household income. Following Robinson (1988), we estimate a model of the following form,

$$y = \alpha + x\beta + g(z) + \varepsilon \tag{5}$$

where $x$ of dimension $n \times k$ is the set of controls and $z$ of dimension $n \times l$ is the household's land endowment. The variable $y$ represents some measure of household welfare. The constant term is denoted by $\alpha$, and $\beta$ is a $k \times l$ vector of our parameters of interest. The error term, $\varepsilon$, is distributed normally. We assume that the functional form of $g(\cdot)$ is unknown and $E(\varepsilon|x,z)=0$. Taking expectations of Eq. (5) conditional on $z$, we get:

$$E(y|z) = \alpha + E(x|z)\beta + g(z). \tag{6}$$

Subtracting (6) from (5) yields:

$$y - E(y|z) = [x - E(x|z)]\beta + \varepsilon. \tag{7}$$

With nonparametric estimates of $E(y|z)$ and $E(x|z)$, we can then estimate (7) by ordinary least squares to get an estimate $\beta$, that is $\sqrt{n}$-consistent, asymptotically normal, and robust to any unknown form of $g(z)$.[3] The estimator for $g(z)$ is simply:

$$\hat{g}(z) = E(y|z) - \left(\alpha + E(x|z)\hat{\beta}\right). \tag{8}$$

There are two important features to note about this procedure. First, since $\hat{\beta}$ converges at a rate of $\sqrt{n}$ and $\hat{g}(z)$ converges at a slower rate of $\sqrt{nh}$ (where $h$ is the bandwidth size), the estimation of $\beta$ does not affect the asymptotic distribution of $\hat{g}(X)$. Second, a constant term cannot be identified independently of $\hat{g}(z)$.

## 4. The data

The data for this study come from the 1997–1998 surveys conducted for PROGRESA. This program targets poor rural communities, and thus our analysis focuses on the value of land for this particular segment of the rural population that lives in marginal communities. The survey covers approximately 25,000 households over 500 localities and 7 states. A stratified randomization procedure selected the localities and every household within each locality was included in the sample. The data are available at the individual, household, and locality levels, with detailed information on schooling, consumption, and employment patterns of the household.

[2] With $k$ explanatory variables and a sample size of $N$ observations, to evaluate the density on a $k$-dimensional grid of $G$ points, requires $NG^k$ evaluations (Deaton, 1997). Even with the semiparametric approach, the income equation took over 8 h to estimate.

[3] Both $E(y|z)$ and $E(x|z)$ are estimated using Cleveland (1979) robust locally weighed regression (LOWESS) technique, using a bandwidth of 0.8.

Table 1
Average farm sizes by land and ownership type

| | Farm size in RFE hectares | | | | |
|---|---|---|---|---|---|
| | All | <1 ha | 1–2 ha | 2–5 ha | >5 ha |
| Distribution of farms (%) | 100 | 30 | 28 | 28 | 14 |
| Farm size (RFE hectares) | 3.09 | 0.70 | 1.40 | 3.09 | 11.09 |
| | (5.55) | (0.24) | (0.32) | (0.83) | (11.27) |
| Rainfed (ha) | 2.68 | 0.62 | 1.14 | 2.47 | 8.10 |
| Households participating in the rental market (%) | 5.1 | 6.2 | 6.2 | 4.4 | 2.0 |
| Rented/sharecropped area, among participants (ha) | 1.71 | 0.68 | 1.21 | 2.63 | 7.3 |
| Irrigated (ha) | 0.14 | 0.002 | 0.017 | 0.074 | 0.67 |
| Households participating in the rental market (%) | 0.4 | 0.01 | 0.17 | 0.62 | 0.94 |
| Rented/sharecropped area, among participants (ha) | 1.8 | 0.25[a] | 0.55[a] | 1.06 | 3.38 |

[a] Denotes less than 10 observations.

### 4.1. Land endowments

With data on both rainfed and irrigated types of land, we convert plot size into hectares of rainfed corn equivalence (RFE). The average yield of corn for both irrigated and rainfed land is calculated for each locality and normalized by the sample average yield of rainfed corn.[4] A household's endowment of land in hectares of rainfed corn equivalence is then the weighted sum of its rainfed and irrigated landholdings, where the normalized averages are used as the appropriate weights (de Janvry et al., 1997). By normalizing farm size by its yield, this adjustment incorporates a measure of land quality, a variable that is typically hard to observe.

The population of the survey is definitely poor, with 52% of households in our sample classified in poverty. Only 54% of the sample possesses land, and the average farm size is less than 2.7 ha. Of the 97% of land that is used for agriculture, 90% is cultivated in corn.

The rental market is very inactive with 5% of farmers participating in the rental market for an average 1.7 ha of rainfed land, which only represents 3.3% of the rainfed area (see Table 1). These proportions are slightly higher with 6% participation and 6% of rainfed land among the small farm size of less than 2 RFE hectares, but this remains negligible. Unfortunately, the data is unclear as to the proportion of farmers who rent-out, but we suspect that this percentage is also small. An *ejido* community exists in 60% of the localities in our sample. This may explain some of the inactivity in the land rental market since, until recently, land transactions were prohibited in all *ejidos*. Although we have no data on land sale or purchase transactions, this market is likely very thin too. We thus retain for our analysis household owned land and make the assumption (that we will test) that land is exogenous.[5]

[4] If the number of observations in a community was less than 30, we averaged yield at the municipality level. Also these averages did not include crop failures, which for rainfed is a yield of less than 0.2 ton/ha and irrigated a yield of less than 0.8 ton/ha.

[5] We test this assumption in our estimation of the welfare equation.

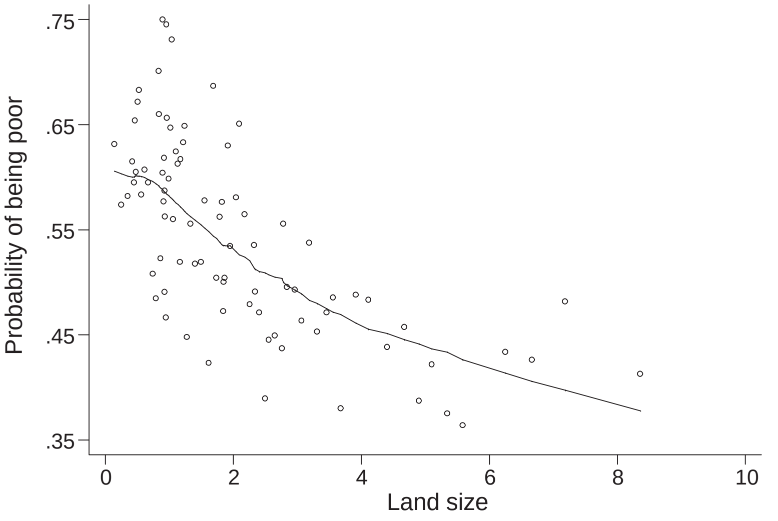


Fig. 2. Poverty and land. To make the graph more readable, each point represents 137 observations.

Fig. 2 provides evidence on the correlation between land and welfare. The association between land and the poverty indicator used by PROGRESA is quite striking. Among those households with less than 1 RFE hectare, 62% are poor. This proportion drops to only 38% when we consider households with more than 8 ha of land.

### 4.2. Welfare index

What is the best measure of welfare is a topic of much debate. Income, which is sensitive to volatile shocks, can be a poor indicator of long-term welfare for households predominately involved in agricultural and self-employed labor activities. With the possibility of households smoothing their consumption across time by borrowing, saving, and mutual insurance, consumption measures are considered much more reliable and more theoretically sound (Ravallion, 1996; Deaton, 1997). Yet, both of these monetary-based measures fail to capture the multidimensionality of poverty, and in effect neglect important dimensions of welfare such as access to sanitation, access to water, and adequate shelter (World Bank, 2001).

With these concerns, we construct a welfare index consisting of various dwelling characteristics (running water, electricity, has a bathroom, number of rooms, and dirt floors), household durables (ownership of a blender, refrigerator, television, and truck), in addition to the short-term measures of consumption expenditure and non-farm labor income. We aggregate these various indicators of poverty using principal component techniques.[6] This indicator thus carries characteristics of accumulated welfare (through

[6] The principal components were computed for each of the seven regions separately. For every region, the first Eigen value captures more than 25% of the total variance and is about three times as high as the next Eigen value. We, therefore, use this first component as our welfare index.

inclusion of durables) and access to public goods (water, electricity) in addition to measures of current flow of welfare (consumption and income).

Table 2 displays the average of various household characteristics by quintiles of the welfare index. There is a consistent positive relationship between assets (land, farm animals, household education level), income, and welfare. The difference in land assets between the highest and lowest quintile is only 2.2 RFE hectares, which is not entirely surprising given our sample of poor communities. The average education level of the households in the highest quintile is almost two full years higher than in the lowest quintile. Poverty is strongly associated with ethnicity, as 50% of households in the lowest quintile are indigenous compared to only 25% in the highest. Also, while the number of agricultural workers per household varies little across quintiles, households in the highest quintile have almost three times the number of nonagricultural workers as the lowest quintile. Households in the highest quintile earn approximately 2.2 times as much as the households in the lowest quintile. Non-labor transfers represent almost the same share of income in all quintiles. Off-farm earnings are an important source of income, especially for those in the lowest quintile where 68% of their total income is derived from off-farm activities.

Thus far, descriptive statistics suggest a positive correlation between land and welfare. In the following section, we explore this relationship further and quantify the economic value of land.

Table 2
Mean characteristics of the poor across welfare levels

| | Quintiles of the welfare index | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | Total |
| Number of households | 2740 | 2740 | 2740 | 2740 | 2740 | 13,700 |
| Land assets in hectares | | | | | | |
| Rainfed | 2.28 | 2.28 | 2.52 | 2.74 | 3.78 | 2.72 |
| Irrigated | 0.06 | 0.08 | 0.12 | 0.18 | 0.32 | 0.15 |
| Total in rainfed equivalence | 2.46 | 2.53 | 2.87 | 3.21 | 4.63 | 3.14 |
| Farm animals | | | | | | |
| Horses, mules, and cattle | 1.10 | 1.47 | 2.19 | 2.84 | 4.45 | 2.42 |
| Household characteristics | | | | | | |
| Number of adult equivalent persons | 4.84 | 5.38 | 5.72 | 5.93 | 5.96 | 5.56 |
| Mean level of education in household | 1.96 | 2.45 | 2.86 | 3.25 | 3.89 | 2.88 |
| Head of household variables | | | | | | |
| Education | 1.91 | 2.31 | 2.46 | 2.64 | 3.04 | 2.47 |
| Age | 47.0 | 48.1 | 48.7 | 49.5 | 51.8 | 49.0 |
| Indigenous head | 0.59 | 0.56 | 0.42 | 0.28 | 0.17 | 0.4 |
| Occupation type within the household | | | | | | |
| Agricultural workers | 0.88 | 0.94 | 0.91 | 0.82 | 0.63 | 0.84 |
| Nonagricultural workers | 0.10 | 0.14 | 0.20 | 0.29 | 0.39 | 0.22 |
| Seller | 0.20 | 0.25 | 0.26 | 0.27 | 0.32 | 0.26 |
| Family-related business | 0.38 | 0.42 | 0.45 | 0.56 | 0.70 | 0.50 |
| Household income | | | | | | |
| Total (pesos per month) | 799 | 933 | 1126 | 1343 | 1848 | 1210 |
| Off-farm wage income (%) | 68.2 | 66.1 | 63.4 | 61.2 | 55.9 | 61.7 |
| Non-labor transfers (%) | 19.4 | 19.9 | 21.1 | 22.0 | 22.9 | 21.4 |

## 5. Estimation results: the welfare generating potential of land

In this section, we estimate a household welfare equation to explore the relationship between land and welfare. There are three main findings. First, compared to the semiparametric approach, a linear specification estimates a much lower marginal value of land both in terms of welfare and consumption. Second, in these poor communities, small plots of land have a large welfare and consumption value. Finally, the marginal value of land differs according to a household's complementary assets and contextual setting.

Our final sample is restricted to the 12,034 landowners with complete household and village level data. We exclude the landless because we are only interested in measuring the marginal value of land for those families that already possess land, and not for households that pursue potentially wildly different livelihood strategies. The final specification of the welfare equation consists in land, household characteristics, social and institutional assets, village characteristics, and states dummies. We also include the number of working-age adults in the household by their education level. Since members of households with smaller farms may tend to migrate more, we incorporate all the household members that have migrated within the last five years into our definition of the number of working-age adults. This will help to mitigate any potential bias in household labor force due to endogenous migration strategies.

### 5.1. Parametric estimation

Regression (A) in Table 3 assumes a linear specification for the welfare index. With our dependent variable measured in welfare units, we divide each of the estimated coefficients by the monetary transfer coefficient, 0.00025, to obtain results that are easier to interpret.[7] This calculation is reported in the fourth column along with its standard error. The marginal welfare value of land is highly significant. An increase of 1 RFE hectare will increase monthly welfare by 125 pesos. For a better sense of the order of magnitude, the average monthly wage of an agricultural worker is 700 pesos, and the price of a metric ton of corn, in 1998, was on average 1460 pesos. With the average yield for rainfed corn at 1 ton/ha, 125 pesos per month or 1500 pesos per year is a meaningful amount. To compare these results with other analyses in the literature, we also estimate this equation for income and consumption. In the income regression, the estimated return to land is not significantly different from zero. In the consumption regression, the estimated return to land is significantly different from zero, but quite small. An increase of 1 RFE hectare increases monthly consumption by 11.5 pesos, which is only 1.5% of average monthly consumption in the sample.[8] This result is of an order of magnitude similar to estimates reported in López and Valdés (2000a). Choice of an adequate indicator of welfare is thus important in assessing the poverty reduction value of land.

[7] Monetary transfers are the monthly amount of pesos a household receives from non-labor sources. This includes government transfers other than PROCAMPO and scholarships.

[8] Several studies also use a log-linear specification. With this specification, we estimate a land to income elasticity of 0.105.

Table 3
Parametric and semiparametric estimation of the welfare equation

| | Average value | Household welfare index | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Parametric (A) | | | | Semiparametric (B) | | | |
| | | Coefficient | *t*-Statistics | Peso value | Standard error | Coefficient | *t*-Statistics | Peso value | Standard error |
| Land assets (RFE hectares) | 3.14 | 0.03 | 8.5 | 125 | 32 | | | | |
| Monetary transfers (×1000) | 39.56 | 0.00025 | 4.5 | 1 | 0 | 0.00024 | 5.1 | 1 | 0 |
| Head of household characteristics | | | | | | | | | |
| Gender (dummy) | 0.92 | 0.30 | 4.8 | 1223 | 370 | 0.29 | 4.7 | 1219 | 349 |
| Age (years) | 49.2 | 0.01 | 9.3 | 61 | 15 | 0.01 | 8.7 | 58 | 13 |
| Education level | 2.49 | 0.09 | 11.2 | 374 | 89 | 0.09 | 11.6 | 379 | 81 |
| Labor force (number of individuals) | | | | | | | | | |
| Male adults with education=0 | 0.19 | −0.04 | −0.9 | −149 | 163 | −0.05 | −1.2 | −210 | 179 |
| Male adults with 0< education <6 | 0.47 | 0.06 | 2.4 | 261 | 125 | 0.06 | 2.0 | 233 | 126 |
| Male adults with education=6 | 0.31 | 0.23 | 7.9 | 925 | 236 | 0.22 | 8.0 | 920 | 215 |
| Male adults with 6< education ≤9 | 0.16 | 0.47 | 12.5 | 1921 | 451 | 0.45 | 12.9 | 1905 | 404 |
| Male adults with education >9 | 0.05 | 0.68 | 9.5 | 2795 | 685 | 0.66 | 10.8 | 2793 | 608 |
| Female adults with education=0 | 0.32 | 0.03 | 0.8 | 102 | 133 | 0.02 | 0.5 | 76 | 140 |
| Female adults with 0< education <6 | 0.44 | 0.30 | 10.0 | 1235 | 296 | 0.29 | 10.0 | 1245 | 273 |
| Female adults with education=6 | 0.28 | 0.54 | 17.8 | 2213 | 503 | 0.53 | 18.1 | 2256 | 460 |
| Female adults with 6< education ≤9 | 0.12 | 0.66 | 15.7 | 2686 | 616 | 0.64 | 16.8 | 2731 | 563 |
| Female adults with education >9 | 0.03 | 1.05 | 11.1 | 4267 | 1021 | 1.03 | 14.4 | 4355 | 916 |
| Children (under 17 years old) | 2.59 | −0.01 | −1.0 | −31 | 33 | −0.01 | −1.3 | −44 | 34 |
| Males, at least 55 years old | 0.35 | −0.12 | −2.4 | −480 | 227 | −0.13 | −2.8 | −543 | 221 |
| Females, at least 55 years old | 0.31 | 0.24 | 6.2 | 973 | 267 | 0.23 | 6.2 | 968 | 246 |
| Social and institutional assets | | | | | | | | | |
| Indigenous household (dummy) | 0.40 | −0.76 | −19.8 | −3117 | 710 | −0.72 | −18.9 | −3060 | 627 |
| Access to agricultural cooperative (dummy) | 0.04 | 0.01 | 0.2 | 56 | 312 | −0.03 | −0.3 | −106 | 327 |
| Church present (dummy) | 0.40 | 0.02 | 0.6 | 78 | 133 | 0.01 | 0.4 | 48 | 134 |
| Migration assets (number of individuals in the village) | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Out of the state | 3.28 | 0.01 | 3.0 | 60 | 24 | 0.02 | 3.1 | 70 | 27 |
| Out of Mexico | 1.21 | 0.06 | 7.3 | 230 | 59 | 0.06 | 9.5 | 241 | 53 |
| Locality characteristics | | | | | | | | | |
| State road (dummy) | 0.17 | 0.22 | 4.8 | 882 | 268 | 0.22 | 5.2 | 952 | 265 |
| Federal road (dummy) | 0.26 | 0.22 | 5.7 | 898 | 255 | 0.23 | 6.4 | 992 | 251 |
| Health center (dummy) | 0.14 | 0.24 | 4.8 | 964 | 292 | 0.21 | 4.6 | 910 | 268 |
| Minimum distance to an urban center (km) | 107 | −0.0044 | −7.4 | −18.0 | 4.7 | −0.0043 | −7.2 | −18.2 | 4.4 |
| Minimum distance to the state capital (km) | 155 | −0.0016 | −3.9 | −6.5 | 2.2 | −0.0016 | −4.2 | −6.9 | 2.2 |
| Male agricultural wage (daily) | 32.6 | 0.0194 | 12.9 | 79.1 | 18.4 | 0.0185 | 13.1 | 78.5 | 16.6 |
| Male non-agricultural wage (daily) | 3.82 | −0.0016 | −1.1 | −6.4 | 5.9 | −0.0014 | −1.1 | −5.9 | 5.4 |
| Male self-employed wage (daily) | 1.69 | 0.0051 | 2.5 | 20.8 | 9.5 | 0.0053 | 2.8 | 22.4 | 9.2 |
| Female agricultural wage (daily) | 13.0 | 0.0044 | 4.3 | 18.0 | 5.7 | 0.0042 | 4.6 | 17.7 | 5.2 |
| Female non-agricultural wage (daily) | 1.14 | 0.0074 | 2.6 | 30.0 | 13.2 | 0.0077 | 3.0 | 32.6 | 12.6 |
| Female self-employed wage (daily) | 1.14 | −0.0002 | −0.1 | −0.7 | 10.6 | −0.0005 | −0.2 | −2.0 | 10.5 |
| Population | 393 | 0.0004 | 5.5 | 1.4 | 0.4 | 0.0003 | 4.9 | 1.4 | 0.4 |
| State dummies (reference is Guerrero) | | | | | | | | | |
| Hidalgo | 0.17 | −0.22 | −3.5 | −893 | 323 | −0.21 | −3.4 | −899 | 316 |
| Michoacan | 0.12 | −1.56 | −18.3 | −6359 | 1438 | −1.63 | −20.7 | −6914 | 1397 |
| Puebla | 0.15 | −0.44 | −6.4 | −1797 | 486 | −0.45 | −6.5 | −1889 | 473 |
| Queretaro | 0.04 | −1.18 | −10.6 | −4826 | 1157 | −1.23 | −12.4 | −5199 | 1104 |
| San Luis Potsi | 0.15 | −0.50 | −6.9 | −2035 | 527 | −0.58 | −8.4 | −2466 | 556 |
| Veracruz | 0.28 | −0.60 | −8.3 | −2438 | 609 | −0.63 | −9.0 | −2686 | 605 |
| Intercept | 1.0 | −1.34 | −9.8 | – | – | – | – | – | – |
| Endogenous variable (mean welfare) | 0.079 | | | | | | | | |
| Number of observations | 12034 | | | | | | | | |
| $F(43, 11{,}990)/F(42, 11{,}992)$ | | 133 | | | | 118 | | | |
| $R^2$ | | 0.32 | | | | 0.29 | | | |

The *t*-statistics are based on Eicker–White corrected standard errors.

Standard errors were computed with the delta method and are displayed in parentheses.

Human capital assets are associated with large welfare effects. A marginal increase in the household head's education level raises welfare by 374 monthly pesos, an amount which is three times the return to 1 ha of land. While addition of an adult male with primary education increases welfare by a significant 925 pesos, the return of an adult male with more than secondary education is 2795 pesos; a differential gain of 202%. Uneducated adults do not contribute to household welfare at the margin, and children and elderly men are negatively associated with household welfare. There is a high cost associated with ethnicity as being indigenous reduces welfare by 3117 monthly pesos. Psacharopoulos and Patrinos (1993) documented that 80% of the indigenous population in Mexico lives in poverty, compared to 17.9% for the non-indigenous population, and in our sample 65% of the indigenous households are in fact classified as poor compared to 44.5% of the non-indigenous. With much of rural poverty associated with ethnicity, it is not surprising that indigenous households have on average a much lower welfare than non-indigenous households.

To capture the role of networks in migration (Winters et al., 2001), migration assets are defined as the number of village members who have migrated out of the state over the last 5 years, separating domestic migration in other states of Mexico from foreign migration. Foreign migration assets contribute 170 more monthly pesos to welfare than domestic migration assets.

Several contextual variables are important determinants of household welfare. Available in only 14% of the villages, the presence of a health center increases welfare quite substantially by 964 monthly pesos. Access to state and federal roads, which helps reduce transactions costs, contributes greatly to welfare, as does proximity to an urban center. After controlling for differential asset positions and village characteristics, state effects remain significant. Relative to Guerrero, all states are poorer.

Before proceeding with the semiparametric analysis, we explore the robustness of our results and consider the possibility of endogeneity bias. Despite the dearth of data on land market activities, our assumption of treating land as exogenous depends on the absence of intergenerational transmission of unobserved characteristics that determine land endowments as well as household welfare. Given our cross-sectional data, it is difficult to imagine a meaningful household level variable that is correlated with land endowments but does not affect welfare. Consequently, we use as instruments variables that are statistically valid, but admittedly ad hoc. On that basis, we instrument land with average village farm size, the number of uneducated males, and the number of uneducated females. The first-stage regression (not shown) indicates that the instruments are strong predictors of household landholdings ($F$-statistic $F(3, 11{,}990)=65.1$). The overidentification test fails to reject the null hypothesis that the instruments are statistically valid (Davidson and MacKinnon, 1993). The IV estimations of the welfare equation produced estimates that were not statistically different from the OLS estimations ($P$-value=0.18).

For another check of robustness, we estimate a village fixed-effects model to test whether any unobserved village-level variable affects the estimated return to land. The fixed-effects estimates of the return to land are slightly higher at 206 pesos but not significantly different from the OLS regression result of 125 pesos ($F$-statistic $F(1, 11{,}526)=1.05$; $P$-value=0.31). As long as land quality remains constant within villages, it

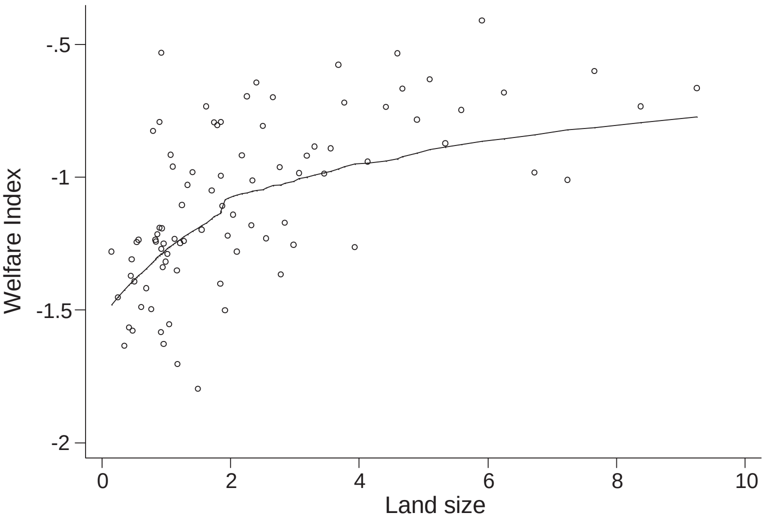


Fig. 3. Welfare value of land. To make the graph more readable, each point represents 120 households.

appears that adjusting land area by its yield has done a reasonable job of controlling for land quality differences across villages. Finally, we estimate a log linear specification of landholdings to discover that, evaluated at the average land size in the sample, the marginal welfare value of land more than doubles to 361 monthly pesos. This result suggests that the choice of functional form does matter and that a semiparametric approach to the data is warranted.

## 5.2. Semiparametric estimation

### 5.2.1. Welfare index

Regression (B) displayed in Table 3 corresponds to the second step of the semiparametric procedure in estimating Eq. (7) above. Interestingly, the semiparametric procedure estimates coefficients very similar to the estimates of the OLS regression, suggesting that land is orthogonal to the other covariates. The resulting semiparametric estimate of the welfare value of land, $g(X)$, is shown in Fig. 3, where welfare appears as an increasing concave function of land. The vertical axis refers to welfare units and includes the constant term. This result suggests that a linear specification would in fact provide a poor approximation.

Fig. 4 displays the marginal value of land for the welfare index along with the 95% point-wise confidence intervals.[9] The $y$-axis has been normalized to the appropriate peso value. An additional hectare of land for farmers with at most 1 ha is associated with an increase in their monthly welfare of 880 pesos (see Table 4). This is an important contribution to welfare as it represents 26% more than an average agricultural worker's

[9] It should be noted that point-wise confidence intervals do not suggest that all the estimated values jointly fall within these bounds (Cleveland and Devlin, 1988).

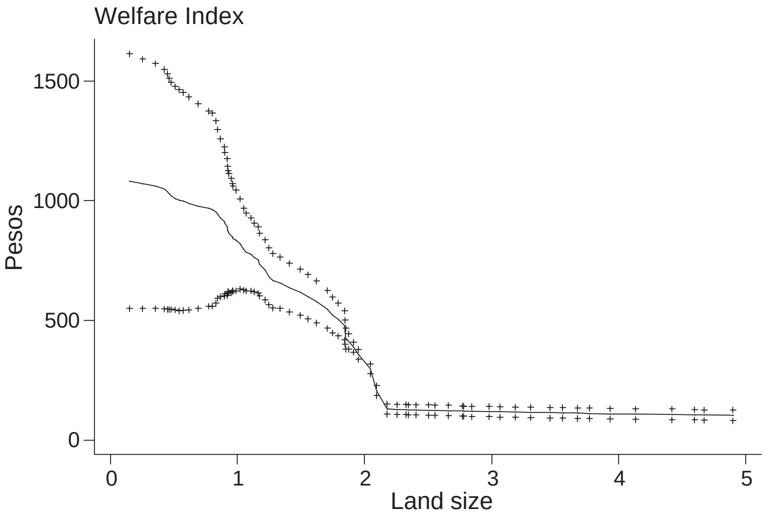


Fig. 4. Marginal welfare value of land.

income. The curve appears to asymptote at an estimated value that is comparable to the parametric fit, suggesting that a linear specification can grossly underestimate the marginal value of land. A simple average of the return to land measured in monthly expenditure over the range of observed farm sizes is 414 pesos, which is more than three times the benchmark case of 125 pesos.

Recalling Fig. 1, the shape of Fig. 4 is remarkably similar to our theoretical predictions of the impact of a labor market constraint on the return to land. Fig. 4 appears to capture the fact that, for small farmers, additional land garners a return that is higher than the simple production value of the extra plot of land. Additional land will increase the marginal product value of household labor and other productive assets, thus reducing the impact of any distortions that may exist. The shape suggests that lack of rural employment opportunities is a possible constraint that these household face.

### 5.2.2. Consumption

To give a better sense of the results and to further emphasize the importance of considering nonlinearities in the return to land, we repeat the semiparametric exercise

Table 4
Marginal value of land in monthly pesos

| Farm size in RFE hectares | Number of households | Welfare index average marginal value of land |
|---|---|---|
| ≤1 | 3557 | 880 |
| 1–3 | 5180 | 301 |
| >3 | 3452 | 102 |
| All | 12,189 | 414 |

using household monthly consumption. Fig. 5 displays the marginal value of land for consumption along with its 95% point-wise confidence interval. Interestingly, the shape of the marginal value of land measured in consumption is remarkably similar to the shape in Fig. 4. An additional hectare of land for farmers with at most 1 ha is associated with an increase in their monthly consumption of 82 pesos, which represents a gain of 14% over average consumption among these households. This is consistent with our previous result that small plots of land for land-poor households have a significant economic value. Even averaged over all households, the marginal value of land is almost four times higher than our original estimate of 11.5 pesos for a linear specification. Compared to the welfare index, the consumption value of land is smaller, which corresponds to the fact that the welfare index measures the household's stock of well-being.

We also estimate this regression with a seventh-order polynomial for land to allow for nonlinearities. Both the shape of the marginal value of land and its magnitude were similar to the slightly more flexible semiparametric approach.

### 5.3. Heterogeneity in the marginal value of land

An important element of the debate on the welfare enhancing value of land is to account for complementary asset endowments and the existence of market failures. The high degree of heterogeneity in both asset positions and exposure to market imperfections suggests that the marginal value of land should not be constant across rural households. While our previous parametric and semiparametric specifications permit the household's demographic and contextual characteristics to shift the welfare equation, we still restrict the coefficient to be the same across a very diverse sample.

The pooling of data across different subgroups may also cause spurious curvature in the semiparametric estimation of land (Bhalotra and Attfield, 1998). Suppose, for example,

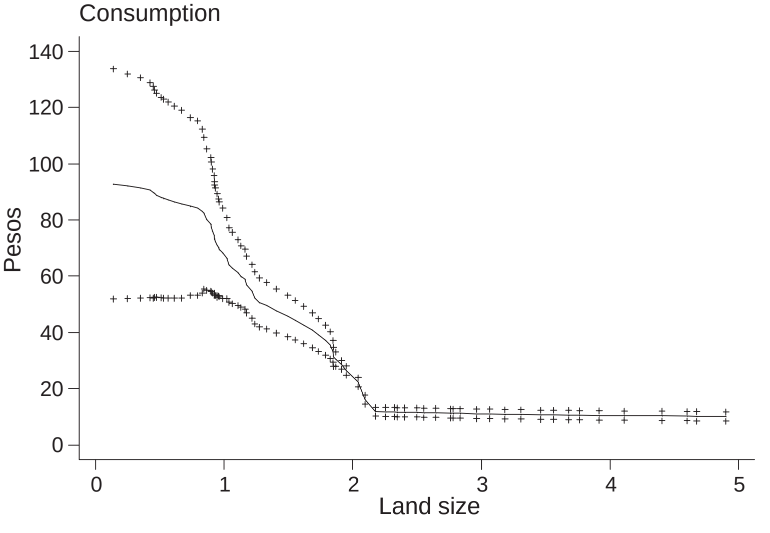


Fig. 5. Marginal consumption value of land.

Table 5
Marginal welfare value of land in monthly pesos

| | Land size | Sample size | Parametric | Semiparametric Farm size | | |
|---|---|---|---|---|---|---|
| | | | | <1 ha | 1–3 ha | >3 ha |
| Head of household education | | | | | | |
| No education | 2.61 | 4108 | 130 (81) | 1092 [1262] | 462 [1764] | 105 [1082] |
| At least primary school | 3.79 | 2033 | 229 (179) | 2011 [588] | 1006 [878] | 245 [567] |
| Ethnicity | | | | | | |
| Indigenous | 2.52 | 4800 | 76.7 (48) | 1277 [1778] | 302 [2090] | 55 [932] |
| Non-indigenous | 3.55 | 7234 | 157.5 (44) | 1045 [1729] | 647 [3021] | 134 [2484] |
| Infrastructure | | | | | | |
| No access to a road | 3.09 | 6875 | 70.9[a] (24) | 594 [2044] | 253 [2983] | 68 [1848] |
| Access to a road | 3.21 | 5159 | 174 (57) | 1213 [1463] | 758 [2128] | 155 [1568] |
| Education and infrastructure for non-indigenous households | | | | | | |
| No education and no access to road | | 1157 | | 393 [289] | 210 [487] | 33 [38] |
| At least primary school and access to road | | 619 | | 2819 [147] | 2200 [269] | 345 [203] |

All these regressions include the same covariates displayed in Table 3. The standard errors shown in parentheses are computed by using the delta method. The figures in brackets are the number of households with the corresponding amount of land.

[a] Denotes difference across subgroups is significant at 10%.

that the relationship between welfare and land is actually linear, but that indigenous land is systematically smaller and produces a higher return. The marginal value of land for non-indigenous households will be lower and lie predominantly to the right of the indigenous sample. While the relationship is in fact linear for each of these subgroups, the combination of these data will result in a nonlinear representation.

Table 5 compares the return to land across subgroups of the population using parametric and semiparametric estimations of the welfare index. Comparing subgroups in the linear specification, only the access/no-access to road split records a significant difference in the return to land. However, when we relax the functional specification, the marginal value of land, as displayed in Fig. 6, does vary across these subgroups, at least beyond 1 ha.

Households with a higher average adult education level achieve a higher return to their land. The income generating potential of land used by indigenous households is less than half that used by non-indigenous households for landholdings greater than 1 ha. Access to a paved road is important for reducing transactions costs on product and factor markets, and households residing in a village with a road garner a higher return to land.[10]

The conditions under which land is accessed is thus fundamental in deriving welfare from land. For non-indigenous small farmers (less than 1 ha of land), an additional 1 ha adds 393 pesos/month for those without education and without access to road, compared to 2819 pesos for those with at least primary education and access to a road (Table 5). For those between 1 and 3 ha, the gain rises from 210 pesos/month to 2200 pesos/month.

[10] Very similar results can be obtained with a seventh-order polynomial in land and all interactions with a dummy variable for high education, indigenous, or road access.

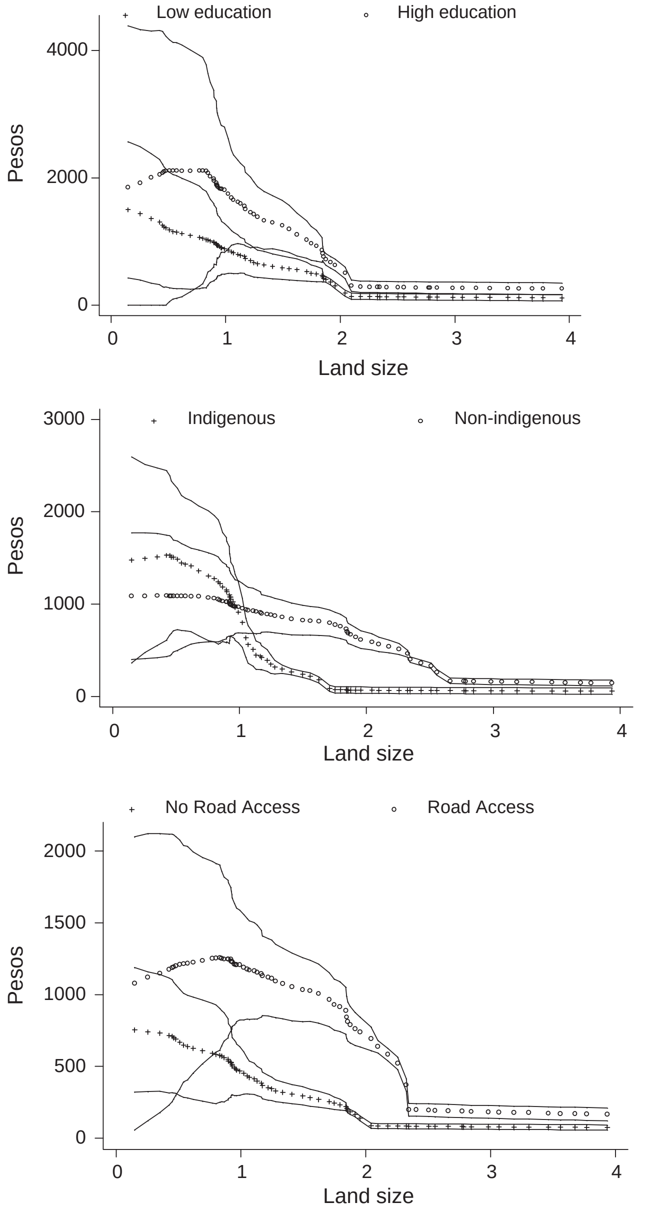


Fig. 6. Marginal value of land across subgroups.

When access to land is combined with complementary assets (education) and public goods (infrastructure), the gain in welfare from an additional 1 ha for these two categories of households is thus three to four times more than an average agricultural worker's income. These results vindicate those who have been arguing for a long time that only programs of access to land accompanied by complementary reforms to secure the competitiveness of beneficiaries can achieve the desired welfare objectives (Warriner, 1969).

Note that, in all the graphs, the general curvature of the land function remains consistent. This provides evidence that the curvature is not spurious.

### 5.4. Heterogeneity in the level of welfare

To better understand the potential of access to land as an instrument to reduce poverty, we investigate how differences in asset position and contextual setting translate into differences in welfare level. In order to decompose these differences, we re-estimate our welfare equation using a spline function for land. In this situation, a flexible parametric specification is needed since the nonparametric approach came at the expense of not being able to identify the constant term. However, the nonparametric exploration of the land to welfare contour does guide us in our choice of the number and location of the knot points, which in a spline regression can be fairly arbitrary.

In the spirit of Oaxaca's (1973) wage-gap decomposition, we explore the welfare differential between subgroups. The welfare gap, $\overline{W}_A - \overline{W}_B$, between group A and group B owning the same amount of land $z$ can be decomposed as,

$$\overline{W}_A(z) - \overline{W}_B(z) = g_A(z) - g_B(z) + \bar{x}_A(\beta_A - \beta_B) + (\bar{x}_A - \bar{x}_B)\beta_B, \quad (9)$$

where $\bar{x}_A$, $\bar{x}_B$ denote the average endowments of the determinants of household welfare, $\beta_A$, $\beta_B$ the estimated parameters, and $g_A$, $g_B$ the spline functions for the two subgroups of households. The first term in Eq. (9) represents, at a given farm size, the difference in the return to land between the two groups. The second term captures differences in the estimated return to the other determinants $x$ of welfare due to omitted factors. The last term is the portion of the welfare gap attributed to differences in endowments.

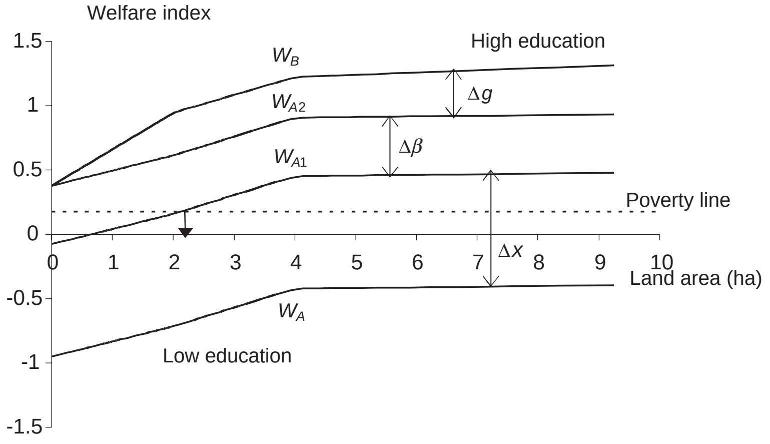


Fig. 7. Welfare as a function of land assets: Role of complementary asset.

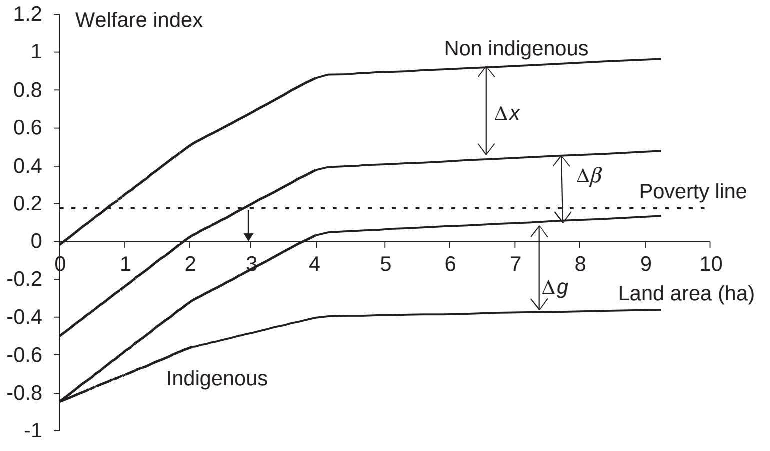


Fig. 8. Welfare as a function of land assets: Role of household characteristics.

*Role of complementary assets*: The decomposition of the difference in predicted welfare levels between households with a low and a high average education level is depicted by landholding size in Fig. 7. The different curves represent the following path in the decomposition:

| | |
|---|---|
| $W_A = g_A(\text{land}) + \bar{x}_A \beta_A$ | Welfare of group A. |
| $W_{A1} = g_A(\text{land}) + \bar{x}_B \beta_A$ | Welfare of group A with non-land assets of group B. |
| $W_{A2} = g_A(\text{land}) \bar{x}_B \beta_B$ | Welfare of group A with non-land assets and return to non-land assets of group B. |
| $W_B = g_B(\text{land}) + \bar{x}_B \beta_B$ | Welfare of group A with non-land assets, return to non-land assets, and return to land of group B=Welfare of group B. |

Here, we see that access to land does little to alleviate poverty among households with low education levels.[11] Differences in endowments explain on average 57% of the welfare gap. This graph emphasizes the importance of an integrated poverty alleviation strategy. A specialized program of access to land for the poor will, consequently, do little to reduce poverty without providing access to complementary assets.

*Role of household characteristics*: Fig. 8 shows the decomposition between indigenous and non-indigenous households. In this case, eliminating the endowment differential between indigenous and non-indigenous households would be insufficient to raise the indigenous households with less than 15 ha of land out of poverty. Non-indigenous households receive an unexplained premium that is on average 55% of the welfare differential. If indigenous households were to receive the same return to their assets as non-indigenous households, they would only require access to less than 3 ha of land to reach the poverty line.

[11] The poverty line was determined by estimating the PROGRESA poverty indicator on our welfare index. The threshold value maximizes the number of correctly classified households.

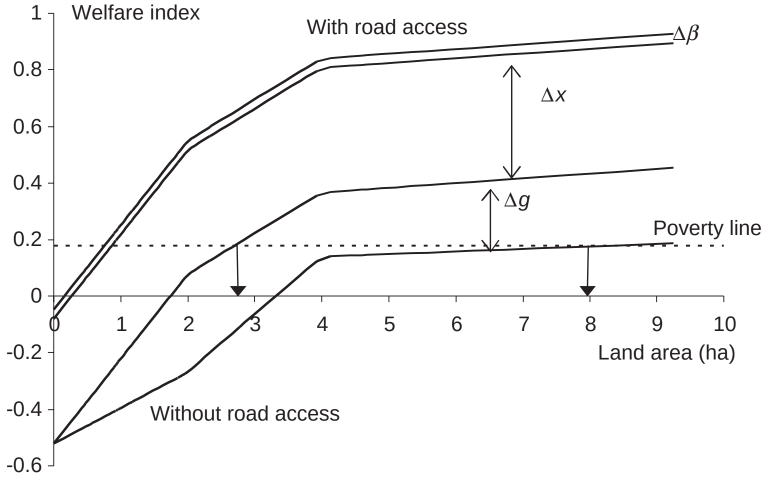


Fig. 9. Welfare as a function of land assets: Role of the context.

*Role of the context*: Fig. 9 plots the difference in welfare between households with and without access to a paved road. With access to a road, households only need less than 1 ha of land to reach the poverty line, compared to households without access who need 8. Again, we see that if there were no difference either in endowments or in this case, in the return to land, less than 3 ha of land would be required to lift households out of poverty.

## 6. Conclusion

Access to land has for a long time been advocated as a strategy to reduce rural poverty (Warriner, 1969; Thiesenheusen, 1989; Dorner, 1992; de Janvry, 1981) and it has recently returned prominently on the policy agenda (Deininger and Feder, 2002). However, there is an active controversy about the value of access to land in reducing poverty. Fair to say is that the conditions under which land can be effective for this purpose have not been satisfactorily established. López and Valdés (2000a) have, in particular, argued that land contributes little to income and that it is consequently better to look at other instruments if rural poverty is a concern. Yet, the methodology that has been used in these studies has several limitations which we proceed to remedy in this paper. We use in particular a semiparametric approach to avoid restrictive specification of an income equation that theory predicts to be non-linear and complex, and a definition of poverty that goes beyond income alone as suggested by recent inter-disciplinary studies (World Bank, 2001). In addition, we believe that any statement about the poverty value of land needs to be qualified in order to recognize the considerable heterogeneity of conditions under which land is accessed. This includes, most particularly, the role of household characteristics, the availability of complementary assets, and the context where land is used. To do this, we estimate the potential of land in reducing poverty in poor rural communities of Mexico in an effort to provide more accurate measurements and to identify the conditions under which access to land can help reduce poverty.

In general, we find that the marginal welfare value of land is quite high for households with less than 1 ha of rainfed corn equivalence. For these farmers, an additional plot of land can increase welfare by as much as 880 monthly pesos, which represents 26% more that the average monthly income of an agricultural worker in the poor communities surveyed. This high return to land captures the increase it creates in the value of the marginal product of other household assets due to market failures, in addition to the increase in the direct production value of the land. We find that the shape of the mapping between land and welfare is consistent with a theory of labor rationing in off-farm employment.

Given the diversity of livelihood strategies across households, we investigate the role that heterogeneity plays in the ability of land to generate welfare. We observe that household characteristics, complementary assets, and contextual circumstances greatly influence the welfare generating potential of land. Social assets such as ethnicity lower the marginal value of land, whereas households with more education receive a higher return to land. Households that face lower transaction costs as measured by access to roads, garner a return to land that is two to three times as high as those without access to a road. Moreover, access to only 1 ha of land can be sufficient to escape poverty for households living in villages with access to a paved road, in large part because Mexican farm households are engaged in off-farm activities than complement incomes derived from land.

These findings suggest that land can indeed be an important element of a poverty reduction strategy, but that there are specific conditions that must hold for this to be the case, calling on complementary interventions. Besides better access to land, it is important to improve control by households over complementary assets such as education, and to improve the provision of public goods such as infrastructure needed for them to make an effective use of the land. We did not address in the paper the question of how much land would be needed and where it would come from, shying away from making any strong statement on massive land redistribution. However, our analysis suggests that programs of access to land must be packaged as elements of more comprehensive programs in order to secure the poverty reduction potential of land. We have established the nature of these complementary interventions for marginal rural communities in Mexico. They need to be systematically established for every particular population of poor for whom programs of access to land are being considered. It is only once this will have been done that the debate on the poverty reduction value of programs of access to land can be put to rest.

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