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ACCESS TO LAND AND RURAL POVERTY IN DEVELOPING COUNTRIES: THEORY AND EVIDENCE FROM GUATEMALA

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Summary.- *The lack of consensus on the social and economic impact from access to land continues to generate heated political and academic debates. The existing empirical literature does not consider possible opportunity costs, factors that can affect this impact and different time horizons. Toward solving this problem, this article elaborates a theoretical argument on the potential benefits, opportunity costs and asset accumulation dynamics that may derive from gaining access to or increasing the size of rural land in developing countries. Empirical tests of the argument and poverty reduction assessment are then carried out using household data from Guatemala. Finally, policy and future research implications are derived.*

Keywords: Access to land, rural poverty, off-farm income, Guatemala.

1. INTRODUCTION

After being central for decades, land reform policies fell from national and international development agendas during the 1980s. The prevalence of a pro-market view in the US and UK governments and in the main international financial organizations, together with a general decrease of agricultural product prices in world markets, made land reforms out of fashion. However, in the face of poverty and inequality pervasiveness, and large areas of underutilized land in many rural areas of developing countries, together with the arrival of more "pro-state" governments in the US, UK and the World Bank, the academic and political debate about public action on the allocation of rural land recharged in the 1990s.

This debate can be broadly summarized according to three current different views. One believes, as did the mainstream international thought during the 1980s, that asset

distribution and the agricultural sector constitute, at best, secondary development factors, and is therefore against public action on rural land distribution. This view calls for the importance of formalizing private property rights in order to allow formal markets to work, and is only willing to support direct public intervention on the provision of public goods like communication infrastructure and education. Academic arguments of this line of thought can be found in de Soto (2000) and Rigg (2006), while political examples are found in the current governments of Colombia, Guatemala and Honduras, all of which ended access to land programs coming from past governments.

A second, opposite view, defends the *essential* development roles of both the agricultural sector and of public action on the distribution of resources. This vision argues that we should go back to extensive (and probably coercive) land reforms, integrating them into broader rural development policies, where the state provides a wide set of complementary support, mainly in the form of access to input and output markets. This view is similar to the developmental state approach of the 1970s, with the novelty that it makes new emphasis on the need to also give a leading role to civil society in the demand, design and execution of these policies. Academic arguments defending this view can be found in Griffin, Khan and Ickowitz (2002) and Akram-Lodhi, Borras and Kay (2007), while political examples can be found in Bolivia's and Venezuela's current rural development strategies, and in many NGO demands (see for example CIP, 2006).

Finally, there is a third, somewhat in the middle view, which argues that both the agricultural sector and the distribution of assets *can be* important development factors, and that the main problems of past land reform efforts were the coercive role played by the state in implementation, and the lack of secure property rights to land. It implies then a rationale for the state to distribute assets, including rural land, but complementing, instead of circumventing, the role of markets. The main supporters of this view are the World Bank, the International Fund for Agricultural Development and the Food and Agriculture Organization, which have been encouraging and financing a new brand of market-based access to land (voluntary) programs since the 1990s (see IFAD, 2001; World Bank, 2003; and FAO, 2006)[1].

Regarding the empirical academic literature, descriptive research in sub-Saharan Africa strongly associates rural poverty with the lack of land[2]. This type of evidence is supported by multivariate econometric work carried out in China (Burgess, 2001),

Ethiopia (Bigsten et al, 2003) and Mexico (Finan, Sadoulet and de Janvry, 2005), all of which find a positive and significant causal effect of land ownership on some indicator of household's welfare[3]. However, an econometric study by López and Valdés (2000) in six Latin American countries finds that access to land ownership has a quite small effect on income, while Carter and May (1999) fail to find in South Africa any impact on income if other financial constraints that poor households face are not removed.

The fundamental problem of this empirical literature is that it is not based on a theory or conceptual framework that considers not only possible benefits, but also possible costs and factors that can affect this impact. Each household makes its livelihood's decisions based on the needs, opportunities and restrictions that they face, and these decisions imply opportunity costs. Within the current context, where most households throughout the rural developing world still are involved in self agricultural activities, but where the proportion of income derived from other sources is growing, with very high inter and intra country variations (Reardon, Berdegue and Escobar, 2001; Haggblade, Hazell and Reardon, 2002; Winters et al, 2006), the opportunity costs of gaining access to land can be high and extremely heterogeneous across different households. Therefore, a better approach would be to try to assess the impact from access to land on both agricultural benefits and the possible loss of off-farm income opportunities.

Furthermore, getting out of poverty is a dynamic process where location and asset accumulation are among the most important elements for each particular household. In our case, if there is a causal relationship between having access to land and the process of accumulating other assets or the place where the household is located, the impact from access to land programs will be different in the short than in the long run.

Not being able to find on the literature a theory that directly addresses these issues, and in order to find some insights, we have searched the extensive literature that exists on the role of agriculture in development. However, after the mid 1960s all the academic literature has been macroeconomic in nature, with mainly no agreed upon significant conclusions (see Sarris, 2001; and Timmer, 2002). After the classic "Transforming Traditional Agriculture" (Schultz, 1964), which convincingly argued that traditional peasants were "poor but efficient," economists abandoned the microeconomic debate on possible behavioral differences between productive sectors. Since then, agricultural microeconomic theory and empirical analysis have focused on how public action can correct market failures in order to promote agricultural development, but not on the issue

of whether these market failures have a different impact on the agricultural sector, or on whether agricultural development is important or not for overall development[4].

The main goal of this article is to develop a microeconomic (i.e. behavioral) narrative theory on the different factors that can affect the relationship between access to land and rural poverty in developing countries (sections two and three). We then perform an empirical test of the theory and assess the short and long run poverty reduction impact of access to land, depending on the opportunity costs faced by the household, using cross sectional household data from Guatemala (sections four through seven). Finally, we draw some policy implications and argue that this theory can also serve as an important ingredient for a needed unified (macro and micro) theory on the role of agriculture in development.

2. A THEORY ON THE POTENTIAL POVERTY REDUCTION IMPACT FROM HAVING ACCESS TO AGRICULTURAL LAND

While the main potential economic benefits from having access to agricultural land are monetary benefits and food consumption derived from agricultural activities or from renting it out, opportunity costs can be thought of as the possible off-farm employment opportunities lost. These costs depend on the off-farm employment opportunities present in the region (the context) and on the specific characteristics of the household (their assets). Let us analyze both types of factors.

Regarding the context, if off-farm economic opportunities – in the form of labour supply or market demand – exist, the opportunity costs of accessing land can be higher than the benefits, due to the higher off-farm labour productivity that is normally present, at least during the developing phases of a country or region (Stern, 1994). Furthermore, an important restriction that an agricultural household faces, especially in developing countries, is the lack of transferability of whatever assets it owns, which normally have a high value for obtaining agricultural benefits and a low value for obtaining off-farm income. This is so because their human and social capital is highly agricultural-specific, and because in most developing countries land property rights (their main physical asset) are still informal and cannot be transferred using formal markets.

Regarding household's assets, a first glance about which might affect opportunity costs can be found in rural off-farm empirical studies in developing countries. For example,

Reardon, Berdegué and Escobar (2001) find in several Latin American countries that having more education, not being indigenous and living closer to a town increases non-farm income. De Janvry, Sadoulet and Zhu (2005) find in China that higher education levels and lower distance to a town increases access to off-farm employment.

However, we can expect that these factors have similar effects on agricultural income. That is, having higher education and living closer to an urban area will not only increase opportunity costs, but also increase agricultural benefits. If benefits and opportunity costs cancel each other, these factors will not have any effect on the poverty reduction impact derived from gaining access to land. But the fundamental hypothesis of our argument will state that household assets and its location differently affect agricultural benefits and opportunity costs. Specifically, we will hold that household size, education level and distance to an urban area have significantly different effects on on-farm and off-farm benefits, and therefore constitute main factors affecting the possible impact from gaining access to land.

In order to explain the possible effects of these factors, we start with a brief description of the literature which analyses the relationships between urbanization, fertility rate, education and economic development. Throughout this literature, there is ample evidence supporting the idea that the process of economic development is closely linked to urbanization, fertility rate decrease and formal education level increase processes (Wrigley, 1969; Schultz, 1985; Bairoch, 1988; Galor, 2005). But it is not until recently that these relationships are being integrated into unified growth theories (Galor, 2005). Actually, Zhang's (2002) and Sato and Yamamoto's (2005) are the only theoretical models that we have found which try to integrate all these factors to explain economic development. Both theories start indicating the fact that poor households face a trade-off between quantity and quality of children – quality in terms of formal education level - implying that the relationship between fertility rates and education is negative. Then, both models offer an explanation of why urban inhabitants choose a strategy characterized by increasing formal education and decreasing fertility rates, while the rural inhabitants choose the opposite strategy. The explanation of the rural strategy relies on the need to have more children to maintain household consumption (Zhang) or income (Sato and Yamamoto), while the explanation of the urban strategy is based on having better access to formal education (Zhang) or on the use of more human capital intensive production technologies (Sato and Yamamoto) at the city.

Our argument is very similar, but we will try to explain the different fertility and educational strategies based on sector (agriculture versus other economic activities) instead of spatial (urban versus rural) differences, which allows us to also consider location as a variable strategy to explain.

We hypothesize that agricultural households in developing countries choose livelihood strategies characterized by living further away from towns, having more children and less formal education. They tend to live further away because the reduction on market transaction costs associated with living closer to towns does not compensate as much the increase in land price because agricultural activities demand higher land quality and size, and allow more self-consumption possibilities. The result is the well known fact that agricultural households end up buying or renting land further away from urban areas.

Our explanation about why agricultural households choose a strategy with more children and less formal education is based on two elements. First, since agricultural labour productivity is normally lower during the initial development phases of the economy, households without access to machinery demand higher labour forces in order to obtain the same level of income. And second, formal education has lower productivity in the agricultural sector of developing countries because a higher proportion of production technology is based on traditional knowledge, informally transmitted within the household and the community.

3. CONSEQUENCES: HETEROGENEITY AND THE AGRICULTURAL POVERTY TRAP

Two are the main consequences that derive from the hypothesis that education, number of children and distance to an urban area differently affect agricultural and non-agricultural benefits. First, even if it can be reasonable to assess the average poverty reduction impact from having access to land in rural agrarian economies, this impact will be much more heterogeneous across households once off-farm income begins to account for an important proportion of total rural incomes, depending on the level of accumulated household assets and on their location. For those households that have invested in formal education and live close to towns, opportunity costs can be higher than benefits, implying that the impact from access to land on welfare would be negative. On the other hand, for those households that live far away from town, have

many children and low education levels, gaining access to land can have close to zero opportunity costs, implying a potentially high welfare impact.

This argument gives a plausible explanation to the apparent contradictions that we have seen in the empirical literature. On the one hand, the insignificant agricultural land effect on income estimated in Latin America and South Africa would come from farmers' lost off-farm economic opportunities in these places. The positive land effect on welfare found in sub-Saharan African countries would come from the lack of off-farm opportunities in this other region.

The second consequence comes from the long-term effects deriving from the fact that agricultural households will tend to live in more remote areas, have more children and less formal education. These differentiated asset accumulation and location dynamics can get households stuck in an "agricultural poverty trap" if the rural economy develops secondary and tertiary economic activities.

We have used the common term "trap" for two reasons. First, because as stated above, agricultural household's assets are normally difficult to transfer in underdeveloped rural areas. And second, due to the fact that reverse causation will probably also be present, whereby households living in more remote areas and having fewer education will tend to remain being farmers. Therefore, we expect causation to flow in both directions, reinforcing the relation between staying in the agricultural sector, living in remote areas, and having lower education levels and higher fertility rates, producing a similar phenomenon to what economists that study institutional and technological change call "path dependency" (North, 1990; Arthur, 1993). This "path dependency" will get households stuck in an "agricultural poverty trap" to the extent that off-farm opportunities arise and the transferability of their assets is low.

In order to check our theoretical argument and estimate the rural poverty impact of access to land according to its main statements, we use cross-sectional household data from Guatemala, a country where most rural households are involved in agricultural activities, but where off-farm income accounts for most of their total income.

4. RURAL GUATEMALA: DATA AND DESCRIPTIVE STATISTICS

We have used the data from the 2000 national living standard conditions survey carried out by the government of Guatemala (ENCOVI, 2000[5]). The objective of this survey

was to identify the social and economic conditions of the national population and, therefore, it aimed to be representative, not of the different farm types, but of all the households in the country. The sample is also representative of both the rural and urban areas of Guatemala. Table 1 provides a summary description of the rural sub-sample[6].

Table 1. Characteristics of Guatemalan rural households across different income levels

	Extreme poor*	Poor	Not poor	Total
Number of households	2326	834	636	3796
Proportion of total (%)	61	22	17	100
Agricultural land assets				
Access to land (%)	82	59	48	71
Ownership of land (%)	59	40	38	52
Has property public document** (%)	73	80	84	75
Average land owned (has)**	4.3	3.3	7.7	4.5
Average land rented in (has)***	2.0	1.7	3.4	2.1
Household characteristics				
Mean education title achieved****	0.7	1.1	1.5	0.9
Average number of persons	6.1	5.4	4.4	5.6
Average in working age (%)	43	50	59	47
Female head (%)	12	16	16	14
Indigenous head (%)	57	39	29	49
Property of dwelling (%)	84	76	81	82
Dwelling property public doc. (%)	48	50	56	50
Average welfare per capita				
Total monetary income (US$)	157	515	1524	464
Proportion off-farm income (%)	81	91	90	85
Self consumption (US$)	141	109	107	129
Income + self-consumption (US$)	298	624	1631	593
Self consumption (%)	48	18	7	22
Own agric. monetary income (%)	9	7	12	10
Own non agric. business income (%)	6	12	20	14
Non self employment income (%)	37	63	61	54

* For illustrative purposes extreme poverty line is set at US$1 per capita and day of total monetary income. Poverty line is set at US$2.
** Only considering households that own land.
*** Only considering households with rented in land
**** For each household member 1= preparatory 2=primary 3=basic 4=diversified 5=university 6=post-graduate
Source: ENCOVI 2000

Many characteristics regarding rural households in Guatemala can be derived from the table. The first aspect that stands out is the high level of rural poverty. Even if we take into account the value of self-consumption, 43% of the rural population are extremely poor and 77% are poor. This rural population depends mainly upon off-farm income,

which contributes 85% of total monetary income and 68% of total income (including self-consumption). However, it is, at the same time, highly involved in agricultural production activities, since 71% of rural households cultivate some land.

In comparison to other rural households, the poorer have less education, larger families, higher dependency (children and old members), and are more attached to agricultural land. However, their monetary income derived from agricultural production is quite small. Their livelihoods depend mainly upon self-consumption of their agricultural production and salaries[7]. As households get richer, livelihoods rely more on monetary income, derived from salaries and/or own (agricultural or other) businesses.

5. ECONOMETRIC MODELS AND EQUATIONS

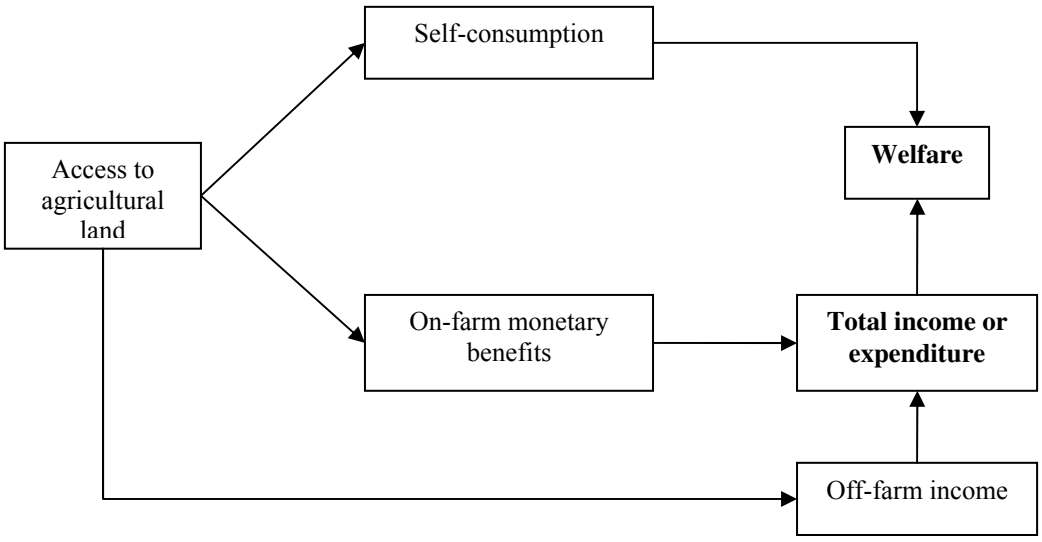
5.1. The welfare impact model

The econometric literature on access to land and poverty reduction described in the introduction section has focused on the measurement of the marginal impact from having one more unit of agricultural land on some indicator of welfare. Without entering into the ongoing debate about which indicator - expenditure or income - is a better measure of welfare, both indicators are actually giving us a measure of monetary activity. Since access to agricultural land will also affect self-consumption, including a monetary value of this consumption into the total welfare index will give us a more complete assessment of its impact. The important point is that whatever indicator we use, we need to clearly make explicit how it is constructed and know the effects that this index can be capturing (see figure 1).

In order to obtain estimates on both benefits and opportunity costs from access to land we also include on-farm and off-farm per capita income, and the value of self-consumption as dependent variables. The value of self-consumption is calculated using ENCOVI data, which specifies products and quantities consumed, and their local prices. The welfare indicator will then be the sum of all these welfare components.

Welfare = per capita on-farm benefits + per capita self-consumption value + per capita off-farm income

Figure 1. The welfare impact paths from access to land



Multivariate models are specified following the "sustainable livelihoods" framework, which states that rural household welfare depends upon their level of cumulated assets, the type of activity in which they are involved and the context in which they develop their livelihood strategy (Carney, 1988; Ellis, 2000). We, therefore, follow the same econometric strategy used in the literature reviewed in the introductory section, but we decompose the welfare indicator, and add a dummy variable indicating whether or not the household is involved in on-farm activities. We also add the time since land was accessed, and compare the results deriving from descriptive and multivariate econometric approaches:

$$\text{Each welfare component} = \alpha + \beta_1 \text{ farmer} + \beta_2 \text{ landown} + \varepsilon \quad (1)$$

$$\text{Each welfare component} = \alpha + \beta_1 \text{ farmer} + \beta_2 \text{ landown} + \gamma \text{ time} + \delta H + \theta L + \varepsilon \quad (2)$$

β_1 and β_2 are the parameters of interest. "Farmer" is a dummy variable that equals one when the household owns or rents in any amount of agricultural land, and zero otherwise. "Landown" measures the hectares of agricultural owned land. Using these two variables we will be able to distinguish the effect of belonging to the farming sector from the effect of having more or less quantity of agricultural land. The estimated coefficient β_1 in the equation where per capita off-farm income is the dependent variable will give us an estimate of the opportunity costs of accessing land.

The variable "time" measures the number of years since the household owns the land. We include this variable in order to estimate β_1 and β_2 more accurately, independently

of the time since land is owned. H represents a set of household controls, including classical variables that try to capture human, financial and social capital.

Since, following our theory, we expect that farmers will tend to live in more remote (and probably poorer) areas, we will use the most specific context controls available in the data. Matrix L then represents a set of dummies for each particular community where the household is located, as a control for context.

Finally, ε represents all those factors which are not included in the model but have some effect on the dependent variable. Based on the "sustainable livelihoods" framework, we make the assumption that controlling for household assets, context and type of activity (being a farmer or not), there are no omitted observable variables in the model.

We also have to make the assumption that there are no omitted unobserved variables, such as land quality and ability. For example, land quality might be negatively correlated with land size, in which case we would get a downward bias on the estimation of β_2. Ability is commonly argued to be positively associated to total years of education, but while this might happen on a personal basis, it does not make much sense on aggregated household variables.

Finally, we also face the ubiquous possibility of having simultaneous causation, whereby the initial level of welfare could also affect the quantity of land or the occupational choice. The problem is that there are no external agents affecting the variables in our model, so we cannot use any instrumental variable to deal with this issue. The only thing we can do is again to try to figure out the possible direction of the possible bias. In this sense, we start remembering that the welfare indicator is constructed as the sum of agricultural production self-consumption value and sales, and off-farm income. In the data, the agricultural components of welfare directly derive from producing the land that the household has, and not the other way around, so there cannot be simultaneity here. On the other hand, it is certainly difficult to theorize about the effect of total household off-farm income on occupational choice and land size. We can think that having more off-farm income might influence leaving the agricultural sector, or staying in it and buying more land. If this is true, we would have a downward bias in the "farmer" estimate (β_1), and an upward bias in the estimation of β_2 (which could offset the downward bias argued above).

In any case, as stated in the introduction, in this article we are more interested on improving our understanding about the factors that affect the poverty reduction impact of access to land, than on finding a proven unbiased estimate of the impact, something that many researchers argue could only be convincingly done using laboratory-like randomized evaluation methods. Therefore, we will just make the (possibly strong) assumption, as in all the articles that have been published on this issue, that equation 2 will give us the estimated direct impact from having access to land (β_1), and the estimated direct marginal impact from having one more hectare of land (β_2).

Equation 1 represents the descriptive approach followed by the studies on access to land impact in sub-Saharan Africa. In this case, coefficients β_1 and β_2 indicate correlations (not direct effects) which are present in the sample. Since in our theoretical argument we are expecting that access to land, location and the accumulation of other assets present causal bi-directional correlations between them, these coefficients serve as a proxy to the long term sum of direct and indirect effects of access to land and land size on welfare.

Simply putt, our theory argued that correlations between the independent variables in the sustainable livelihood framework (equation 2) are causal and bi-directional. Therefore, β_1 and β_2 in equation 1 will give us a proximate estimate of the historical, path-dependent, direct and indirect, welfare impact from access to land in Guatemala. On the other hand, β_1 and β_2 in equation 2 will give us a shorter term estimate of the direct welfare impact of having access to land in Guatemala.

5.2. The factors that affect the welfare impact form access to land

The theoretical hypothesis stated that formal education, number of household members and location (distance to a town) differently affect agricultural benefits and opportunity costs. In order to check if this is the case in Guatemala and assess the magnitude of these differences, we will estimate the following equation:

Y = off-farm income (opportunity costs) – on-farm income (monetary benefits + self-consumption value)

$$Y = \alpha + \delta\,\text{farmer} + \theta\,\text{landown} + \beta_1\,\text{time} + \beta_2\,\text{title} + \beta_3\,\text{headage} + B_4\,\text{femhead} + \beta_5\,\text{indighead} + \beta_6\,\text{education} + \beta_7\,\text{housesize} + B_8\,\text{nodepend} + \beta_9\,\text{savings} + \beta_{10}\,\text{organization} + \beta_{11}\,\text{distance} + \varepsilon \quad (3)$$

In this case, the equation does not represent a choice model, since households don't try to maximize or minimize Y. It just serves to illuminate how the main factors of our

argument can differently affect benefits and opportunity costs. The variables that served as controls in equation 2, now become the variables of interest and vice versa. "Title" indicates weather land has a property title or not; "headage" indicates the head of the household age; "femhead" is a dummy variable indicating weather the household is headed by a female; "indighead" is a dummy variable indicating weather the household is headed by an indigeous person; "education" represents the average title obtained by the household members; "housesize" indicates the number of household members; "nodepend" indicates the proportion of household members in working age (from 15 to 55 years old); "savings" is a dummy variable indicating weather the household has monetary savings or not; and "organization" indicates the proportion of household members which participate in typically poor organizations[8]. Finally, instead of using a matrix of location dummies, we now introduce the variable "distance", which measures the time that it takes to travel, with the most commonly used vehicle, from the community where the household is located to the closest town[9].

According to this equation, those variables which have a positive and significant coefficient will represent factors whose marginal increase is related to a higher marginal increase in opportunity costs (off-farm income) than in agricultural income. And vice versa, those variables which have a negative and significant coefficient represent those factors that have a stronger association with on-farm income than with off-farm income.

5.3. Capturing the possible long term agricultural poverty trap

In order to explore the possible association between being a farmer and living in more remote areas or accumulating fewer economic assets we will estimate the following models:

$$\text{Asset accumulation} = \alpha + \beta_1 \text{farmer} + \beta_2 \text{landown} + \varepsilon \quad (4)$$

$$\text{Asset accumulation} = \alpha + \beta_1 \text{farmer} + \beta_2 \text{landown} + \pi \text{ income} + \delta H + \theta L + \varepsilon \quad (5)$$

$$\text{Distance to closest town} = \alpha + \beta_1 \text{farmer} + \beta_2 \text{landown} + \varepsilon \quad (6)$$

$$\text{Distance to closest town} = \alpha + \beta_1 \text{farmer} + \beta_2 \text{landown} + \pi \text{ income} + \delta H + \varepsilon \quad (7)$$

The number of household members, the mean education title achieved and a dummy variable indicating whether the household has financial savings or not, will form the set

of dependent variables used to measure asset accumulation. In this case we also introduce per capita income as a control.

Similar to the above models on welfare impact, equations without controls (4 and 6) represent the descriptive approach, with coefficients of interest (β_1 and β_2) showing the sum of direct and indirect relations, while equations with controls (5 and 7) showing direct causality. However, it must be noted that in this case we are expecting the direction of causality to run in both directions between dependent and independent variables. We cannot therefore interpret coefficients as impacts, but as reinforcing, two way causalities which produce path dependency.

6. ESTIMATION METHODS

With the exception of Finan et al. (2005) and Carter and May (1999), a linear relationship between land quantity and welfare is used to estimate the models in the econometric empirical literature. That is, one more hectare of owned land is expected to have the same impact on welfare independent of the amount of land that a household already owns. However, as Finan et al. (2005) argue, credit and labor market imperfections cause that many households will not be able to maintain production intensity as land area increases. Therefore, it is very likely that the relationship between land area and welfare has a more complex form, probably with decreasing slopes.

The easiest device in econometric modeling for allowing nonlinear correlations is to either use logarithms for the dependent or independent variables or to add quadratic or even cubed independent terms. However, non-parametric regression estimation methods have the advantage that they don't impose any particular functional form to the correlation between the explained and the explanatory variables, which allows us to have a better understanding on the actual shape of the correlations present in the sample.

For our empirical analysis we will combine the use of Ordinary Least Square (OLS) multivariate regressions[10] with the use of a multivariate scatterplot smoother developed by Royston and Cox (2005). This non-parametric multivariate scatterplot will help us understand the shape of the relationship between land quantity and the different welfare components analyzed. We will afterwards use this information to stratify the sample and compute again regular OLS regressions for each stratum. Robust t statistics are used

after OLS because both Breuch and Pagan's (1979) and White's (1980) tests suggest the presence of heteroskedasticity in the sample.

7. EMPIRICAL ANALYSIS

7.1. Results from the welfare impact model

We start the welfare impact analysis by showing the results from a classical OLS regression using both monetary and total income (monetary income plus self consumption value) as indicators of welfare (table 2).

Table 2. The influence of using different welfare indicators and including controls

	Y_1= annual monetary per capita income (US$)		Y_2= annual total per capita income (US$)	
Being a farmer (dummy)	**-401.195*****	**-208.202*****	**-295.842*****	**-101.638*****
	(12.20)	(7.97)	(8.89)	(3.79)
Agricultural land owned (ha)	**5.635***	**3.900**	**6.952****	**5.407***
	(1.80)	(1.33)	(2.19)	(1.82)
Time since land is owned (years)	1.460	1.705*	2.171**	1.998**
	(1.49)	(1.78)	(2.13)	(2.02)
Head's age (years)		2.216***		2.899***
		(2.64)		(3.38)
Female head (dummy)		-68.777**		-78.346**
		(2.30)		(2.58)
Indigenous head (dummy)		-55.905***		-68.836***
		(2.81)		(3.34)
Mean education (title obtained)		298.367***		286.953***
		(10.99)		(10.49)
Number of members		-39.576***		-46.503***
		(8.94)		(10.27)
Proportion in working age		133.849**		157.239**
		(2.15)		(2.48)
Financial savings (dummy)		633.181***		632.871***
		(7.47)		(7.46)
# of members in poor organizations		-66.138*		-22.775
		(1.72)		(0.58)
Observations[11]	3790	3790	3790	3790
Adjusted R-squared	0.05	0.26	0.03	0.24

Robust t statistics in parentheses. Community dummies included in columns 2 and 4 but not reported.
* significant at 10%; ** significant at 5%; *** significant at 1%

Just using monetary income and not adding control variables, farming households with less than 69 ha of agricultural land are poorer than the rural landless households[12]. Now, if we take into account the value of self consumption, farmers with more than 40 ha have more welfare than landless non farmers. As stated above, this result shows the direct and indirect effects of access to land on welfare, and can be a measure of the low long term effect that having access to land has produced in Guatemala. If we now control for

location and other assets, we get that those households with more than 9.1 ha have more welfare than landless non farmers, which would be an estimation of the short run impact from having access to land.

In any case, implementing an extensive access to land program in Guatemala would not seem to be advisable. Even in the case that the program would be implemented good enough as to select only those households which do not have any other potential income source except for farming[13], it would have to assure that each one of them reaches 67.5 ha of land in order to obtain an increase of one daily US$ per capita[14]. We try next to find what might be behind these poor first-sight results. Note that here is where most of the literature on access to land and rural poverty ends.

7.2. Decomposing the welfare indicator

In the next table we divide the welfare indicator into its different components. It can be seen why the aggregate effect from being a farmer on total income is negative: being a farmer has a strong negative effect on off-farm income, which more than offsets its positive effect on on-farm monetary benefits and self consumption.

Table 3. The relationship between land and different types of benefits (in US$)

	Y1 = Pc on-farm monetary benefits	Y2 = Pc self-consump-tion	Y3[1] = On-farm pc total benefits	Y4 = Off-farm pc income	Y5[1] = Monetary pc income	Y6[1] = Total pc income
Being a farmer (dummy)	**77.326*** **	**106.56*** **	**183.89*** **	**-285.5*** **	**-208*** **	**-101.6*** **
	(5.92)	(18.42)	(12.59)	(12.25)	(7.97)	(3.79)
Agricultural land own (ha)	**6.195*** **	**1.507*** **	**7.702*** **	**-2.295***	**3.900**	**5.407***
	(2.98)	(4.86)	(3.60)	(1.82)	(1.33)	(1.82)
Time land owned (years)	1.005*	0.293	1.298**	0.701	1.705*	1.998**
	(1.90)	(1.20)	(2.17)	(0.95)	(1.78)	(2.02)
Head's age (years)	0.724	0.683***	1.407**	1.492**	2.216***	2.899***
	(1.38)	(4.28)	(2.50)	(2.33)	(2.64)	(3.38)
Female head (dummy)	-35.32***	-9.569	-44.89***	-33.452	-68.78**	-78.346**
	(4.34)	(1.42)	(4.17)	(1.15)	(2.30)	(2.58)
Indigenous head (dummy)	-40.69***	-12.931**	-53.62***	-15.211	-55.9***	-68.83***
	(3.62)	(2.37)	(4.20)	(0.95)	(2.81)	(3.34)
Mean education (years)	21.867**	-11.41***	**10.453**	**276.50*** **	298.4***	286.9***
	(2.13)	(3.01)	(0.93)	(10.97)	(10.99)	(10.49)
Number of people	-11.46***	-6.927***	-18.39***	-28.11***	-39.6***	-46.50***
	(4.73)	(7.38)	(6.91)	(7.88)	(8.94)	(10.27)
Proportion in working age	17.903	23.390*	41.293	115.945**	133.85**	157.24**
	(0.77)	(1.85)	(1.53)	(1.99)	(2.15)	(2.48)
Financial savings (dummy)	87.859**	-0.309	87.550*	545.32***	633.2***	632.9***
	(2.02)	(0.03)	(1.93)	(7.59)	(7.47)	(7.46)
Members in poor orgs. (#)	-41.112**	43.363***	2.252	-25.026	-66.138*	-22.775
	(2.16)	(4.94)	(0.11)	(0.74)	(1.72)	(0.58)
Observations	3790	3790	3790	3790	3790	3790
Adjusted R-squared	0.06	0.26	0.13	0.30	0.26	0.24

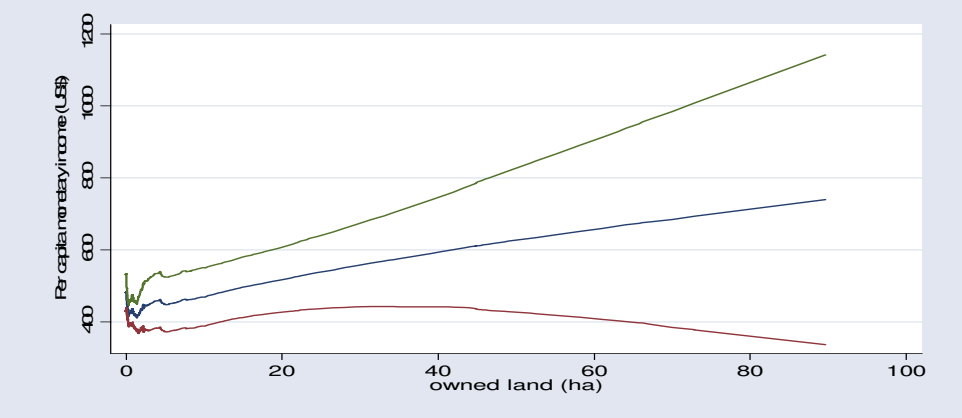
Robust t statistics in parentheses. Community dummies and constant term included but not reported.
[1] Y3 = Y1+Y2; Y5= Y1+Y4; Y6= Y1+Y2+Y4 * significant 10%; ** significant 5%; *** significant 1%

However, the data from table 3 leads to better expectations from possible access to land programs. If we again assume that a program would be able to select only those households with practically zero opportunity costs, which can now be done by ignoring the off-farm negative coefficient of being a farmer, we can argue that an average benefit of one daily US$ per capita would be reached by assuring an average of 22 ha of agricultural land to farmers[15]. Nonetheless, we would still be far from being able to recommend an access to land program in Guatemala based on these results.

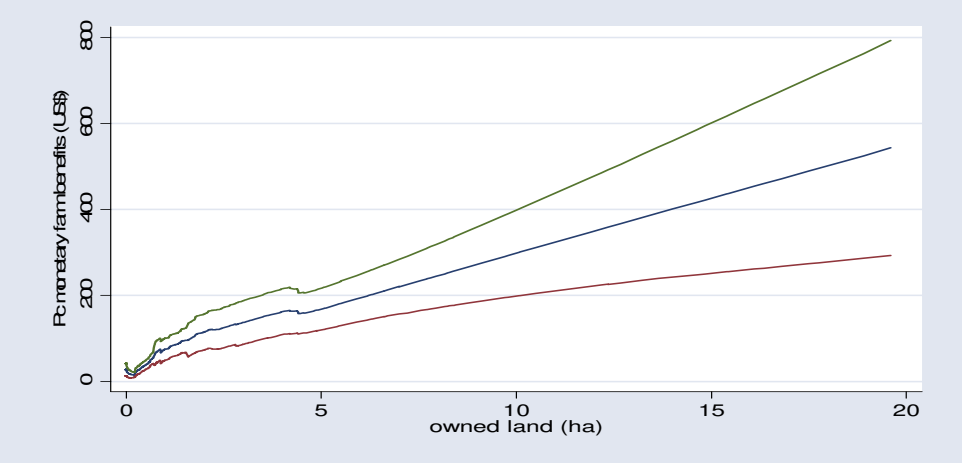
7.3. Relaxing the functional form and stratifying the sample

We go now a step further and analyze if different quantities of land owned differently affects each of the different indicators. In other words, instead of imposing a linear relationship we now relax the functional form between land quantity and each income indicator with the help of multivariate non-parametric regression scatterplots.

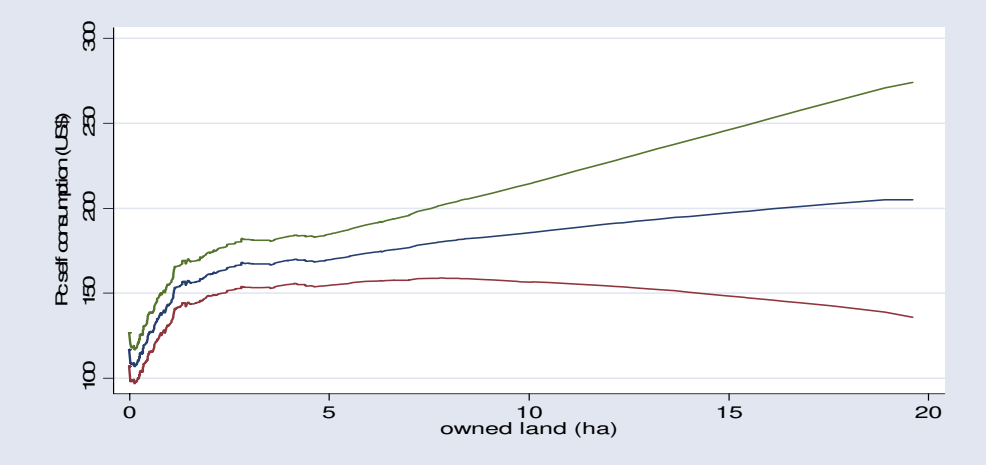
Graph 1. Per capita monetary income and farm size[16]



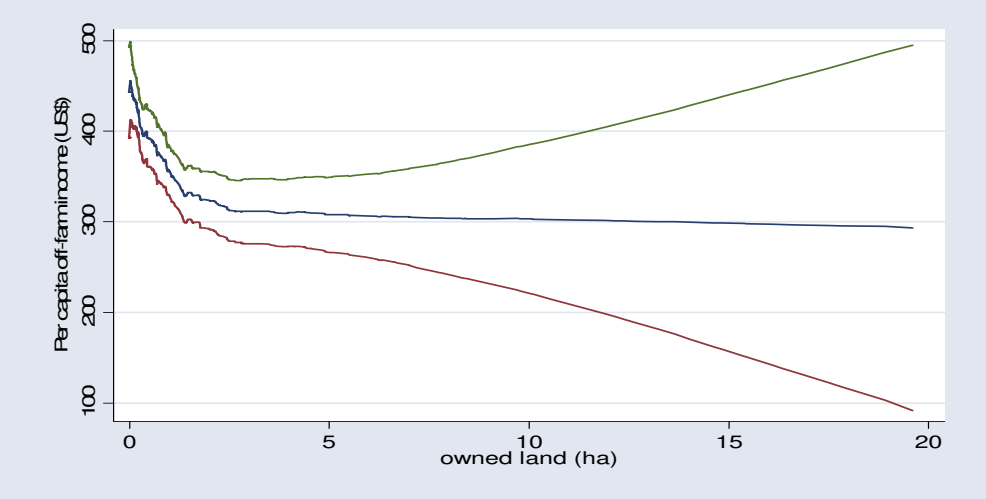
Graph 2.Per capita monetary farm benefits and farm size



Graph 3. Per capita self consumption value and farm size



Graph 4. Per capita off-farm income and farm size



From the graphs one can see that it is right in the small quantity levels of land owned where major changes take place: farm monetary and self consumption benefits greatly increase while off-farm income greatly decreases. Based on the graphs we now run OLS regressions splitting the sample into two groups to see how coefficients are affected (table 4).

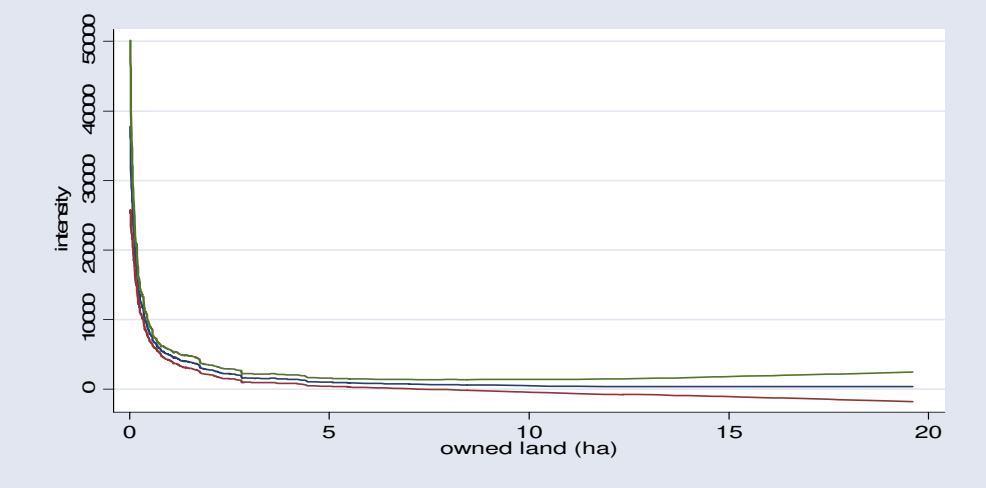
The extraordinary differences in productivity between small and medium to large farms observed in table 6 must be due to either differing incentives or to the lack of capital. Large owners produce less intensively than small owners either because they rely more on off-farm benefits or because they do not have enough capital to proportionally increase investments and inputs (see graph 5).

Table 4. The relationship between agricultural land, on-farm benefits and off-farm income, stratified by land size

Farm size strata		On-farm monetary benefits (US$)	Self-consumpt. (US$)	Total farm benefits (US$)	Off-farm income (US$)	Total income (US$)	Obs.
0 -2 ha	Being a farmer	55.81***	112.09***	**167.90*** **	**-251.6*** **	**-83.7*** **	3347
		(4.95)	(18.58)	(13.05)	(11.49)	(3.37)	
	Agric. owned land (ha)	61.84***	37.787***	**99.62*** **	**-56.94*** **	**42.67**	
		(2.70)	(5.34)	(4.04)	(3.54)	(1.52)	
	Ownership time (years)	-0.65	-0.675**	-1.32**	1.378*	0.055	
		(1.26)	(2.49)	(2.22)	(1.67)	(0.05)	
2-90 ha	Agric. owned land (ha)	5.40**	0.662	**6.06** **	-0.379	**5.684**	442
		(2.04)	(1.50)	(2.27)	(0.21)	(1.39)	
	Ownership time (years)	3.35	1.534*	4.888	1.482	6.370	
		(0.84)	(1.89)	(1.20)	(0.58)	(1.16)	

Robust t statistics in parentheses. Local dummies, household controls and constant term included but not reported.
* significant at 10%; ** significant at 5%; *** significant at 1%

Graph 5. The relationship between productive intensity and farm size[17]



However, the most important fact is that if we now ignores off-farm opportunity costs, a farming household would only need 2 ha of agricultural land to get an average benefit of one daily US$ per capita. But, if we take opportunity costs into account this average household would be just even: it would earn the same from on-farm activities that it would fail to gain from off-farm activities.

7.4. The factors that affect the poverty reduction impact of access to land

In order to test the main hypothesis of the theoretical framework – that household assets and location differently affect access to land benefits and opportunity costs – we start showing the results from the OLS estimation of equation 3 (table 5). We can see that

non-indigenous households, with less formal education, fewer members, no savings and living further away from urban areas are the ones who gain more benefits from on-farm than from off-farm activities. We could think of these types of households as the ones who would probably benefit more from getting access to land or increasing the size of their farm. On the contrary, those household that have the opposite characteristics have more off-farm opportunities, which means that getting access to land or increasing their farm size would probably make them poorer, if they had to pay for it.

Table 5. Differential relationship between assets, on-farm income and off-farm income

	Off-farm income − on-farm income (monetary benefits + self-consumption)
Being a farmer (dummy)	-454.477***
	(16.66)
Agricultural land owned (ha)	-10.027***
	(5.40)
Time since land is owned (years)	-1.734*
	(1.70)
Titled agricultural land (dummy)	34.699
	(1.48)
Head's age (years)	0.298
	(0.41)
Female head (dummy)	-7.201
	(0.27)
Indigenous head (dummy)	36.092*
	(1.94)
Education (average title obtained)	226.336***
	(10.47)
Number of members	-8.897**
	(2.25)
Has savings (dummy)	288.820***
	(3.44)
Proportion of members in poor organizations	-14.916
	(0.40)
Distance from community to town (hours)	-23.965***
	(3.34)
Observations[18]	3091
Adjusted R^2	0.25

Robust t statistics in parentheses. Constant term included but not reported.
* significant at 10%; ** significant at 5%; *** significant at 1%

Therefore, we see that evidence in rural Guatemala supports our main theoretical hypothesis: education, distance to urban areas and number of household members, all have a differently associated with on-farm and off-farm incomes. In this case, ethnicity and savings also have different relationships. Indigenous households probably get higher earnings from off-farm income due to their involvement in the important handicraft and textile industry of rural Guatemala. The higher association of savings with off-farm

income can also be interpreted as a different accumulation dynamic of this asset between sectors.

7.5. The causal association between access to land, location and other assets: evidence on the existence of an "agricultural poverty trap"

We continue the empirical analysis estimating equation four to seven in order to see if we can find any evidence on that being a farmer may lead to live in poorer areas and to have fewer economic assets (table 6). As it can be seen in columns two, four, and six, being a farmer is directly and causally associated to having more household members, less education and living further away from urban areas. Columns one, three, and five show the sum of direct and indirect associations between the same variables, which end up strengthening the links in the longer term, providing more evidence on the existence of path-dependency[19]. On the other hand, once being a farmer or not is controlled, quantity of agricultural land is causally associated with household size and distance to a main urban area, but not with education.

Table 6. Evidence on the causal association between agricultural land and household size, educational level and distance to town.

	Number of members		Mean education (title obtained)		Distance from the community to an urban area (hours)	
Being a farmer (dummy)	**1.061*****	**0.706*****	**-0.321*****	**-0.127*****	**0.256*****	**0.163*****
	(11.81)	(6.78)	(11.50)	(4.87)	(5.00)	(2.75)
Agricultural land owned (ha)	**0.023*****	**0.023*****	**0.004*****	**0.001**	**0.012*****	**0.012*****
	(3.63)	(3.58)	(3.70)	(0.39)	(4.09)	(4.01)
Time land is owned (years)		0.004		-0.001		0.002
		(0.80)		(1.16)		(1.40)
Per capita income (US$)		-0.00***		0.000***		-0.000
		(6.73)		(8.88)		(0.46)
Head's age (years)		-0.004		0.001		-0.000
		(1.49)		(1.16)		(0.28)
Female head (dummy)		-1.16***		0.038		-0.033
		(9.56)		(1.25)		(0.55)
Indigenous head (dummy)		0.291***		-0.197***		-0.065
		(3.09)		(9.17)		(1.61)
Education (title obtained)		0.599***				-0.21***
		(8.93)				(6.38)
Number of members				0.032***		0.018**
				(8.90)		(2.23)
Proportion in working age		-2.32***		0.993***		0.042
		(11.51)		(18.36)		(0.47)
Financial savings (dummy)		0.042		0.357***		-0.083
		(0.26)		(7.87)		(0.88)
Proportion members in orgs.		-0.71***		0.267***		-0.064
		(4.93)		(7.90)		(0.96)
Observations	3790	3790	3790	3790	3091	3091
Adjusted R-squared	0.04	0.13	0.04	0.33	0.02	0.03

Robust t statistics in parentheses. Constant term included but not reported.
* Significant at 10%; ** significant at 5%; *** significant at 1%

As it can be seen in the tables from the above sections, the negative welfare impact from having more household members, having less formal education and living in more remote locations is significant and quantitatively important, mainly due to their negative effect on off-farm income. This implies that possible short term benefits from gaining access to land can however give up to an agricultural poverty trap, whereby these benefits can turn to be negative in the long term.

8. CONCLUSIONS AND POLICY IMPLICATIONS

The results from this study show how in a country like Guatemala, where approximately 70% of the rural population is involved in self-production agricultural activities but only 32% of their income (including the value of self-consumption) is derived from these activities, only those households with more than two hectares of agricultural land are found to be on average less poor than the landless rural households. Due to either lack of capital or lack of productive incentives, as land holdings get larger productive intensity decreases, implying that an amount of at least 67 hectares of land per household would be needed to obtain an average increase of US$ 1 per capita and day. The conclusion from these results is that extensive land distributions are not a cost-effective solution for rural poverty reduction in countries where off-farm income is becoming increasingly important in sustaining rural household livelihoods.

However, theory and results from this study also show that the reason for this poor welfare impact estimates from access to agricultural land mainly comes from the high opportunity costs, in terms of lost off-farm opportunities, derived from entering into the self-employment agricultural sector in rural Guatemala. If, instead of considering the total rural population, we now focus only on poor rural households with little or no land which do not face any real off-farm opportunities in the short term, results show that the same two hectares of agricultural land suffices to gain an average total welfare increase of US$ 1 per capita and day, an amount that can get a rural household out of poverty. On average, half of this welfare increase comes from self-consumption and the other half from selling agricultural products. Therefore, if an access to land program is able to select this type of beneficiary, its short run poverty reduction potential can be significant and important.

One may then observe the same seemingly contradictory picture that was laid out in the introduction. On the one hand agricultural benefits are getting proportionally smaller against other economic activities in many rural areas of the developing world. On the other hand, still high proportions of the rural poor households are involved, either totally or partially, in agricultural activities, whereby access to small amounts of agricultural land can enable them to reap important and quick benefits in the forms of self-consumption and monetary income.

Land policy implications from these results can be crucial. Depending on their particular ideology, many academics and policy makers have normally focused - and still do - on one or the other side of the picture. Putting it simply, the more pro-agrarian and pro-distribution view tends to see only the positive on-farm side while the more anti-agrarian and pro-market view tends to see only the negative off-farm side. So, who is right?

The answer depends upon the time frame, the likelihood of future non-agricultural opportunities, and on how access to land policies are designed and implemented. Based on our theory and results, supporting access to land for poor households that do not face off-farm opportunities can help them get out of poverty in the short term, but can also "push" them towards a long term "agricultural poverty trap" if new off-farm opportunities arise and asset transferability is low. This is so because being a farmer can imply living further away from urban areas (with less public service and more transaction costs), having less formal education and having more family members.

The question now would be: how do we reconcile the short term benefits with the possible long term costs?. Public policy interventions to reduce this long term agricultural poverty trap would have to take into account: (1) to not further augment the trap with regulatory restrictions on the transferability of land, as has been the case with many access to land programs; (2) to formalize land property rights in order to facilitate its transferability; and (3) to not distort existing market incentives, neither towards access to agricultural land nor against it.

In great part due to the contradicting visions on the benefits from access to land explained above, the current trend in rural programs of many developing countries is to either implement ambitious access to land projects or to implement income generation projects where explicitly access to land cannot be the subject of support. Both approaches impose artificial incentives on the beneficiaries and, since they are based on ideologies towards or against the agricultural sector and asset distribution, often fail to

survive a change in government. In our view, a more effective approach would be to implement more stable and flexible rural income generation programs where access to land can be the subject of support, as with any other asset that the beneficiary needs. In this way, potential beneficiaries will weight, at least the short term, potential benefits and opportunity costs from investing in either agricultural activities (including getting access to more land) or on off-farm activities. Longer term concerns of a possible agricultural poverty trap would depend on factors external to the beneficiary, whereby if the region as a whole develops, it is highly probable that new off-farm opportunities with higher benefits will arrive. Expecting this probability, the public program would just have to assure as far as possible the future transferability of assets, in order to allow for greater flexibility.

9. FUTURE LINES OF RESEARCH

We would like to finish indicating two future lines of research that derive from this study. One is theoretical, related to the role of agriculture in development, and the other one is applied, related to the design of rural development public intervention instruments.

The narrative theory developed here offers a behavioural explanation about how the traditional agricultural sector hinders the process of urbanization, the extension of formal education and the reduction of fertility rates. We have used this theory to asses the poverty reduction impact from access to land, but it can also be extended to analyze the economic development role of agriculture. In this sense, we could argue that these mentioned effects from traditional agriculture hinder technological progress and cause higher demographic pressures, with the consequent negative impact on economic development.

Based on this argument it could then be justified that public action should focus on the industrial and service sectors and marginalize the agricultural sector, at least during the initial developing phases of a nation or region. However, this conclusion would be misguided since the argument laid in this article only applies to the long term, and is also only partial. That is, it does not represent all the possible causal relationships between the development of the agricultural sector and overall economic development. In order to fully establish these relationships one would need to integrate at least the

microeconomic approach of our theory with the macroeconomic approach that has been followed throughout the last decades. The main line of agricultural macroeconomic theories, initiated by the work of Johnston and Mellor (1961), makes a strong emphasis on the positive interaction between agriculture and other sectors of the economy, which must also be considered. This theoretical integration of macro and micro approaches could help unblock the never ending debate on the economic development role of agriculture.

The other future line of research, more than an extension of this study, would be complementary and more applied in nature. This line consists on the impact assessment of land taxes, subsidies, titling, and market regulation on land productivity and land market activity. All these elements form the set of available land administration instruments, which, via their impact on land market activity and land productivity, could have a significant impact on the benefits and costs of gaining access to land. All these public instruments can increase or decrease the supply of land in formal markets, with the consequent impact on the cost of accessing land; and can also promote or hinder productivity incentives, with the consequent impact on the benefits from gaining access to land. We still know, however, little on how to design these instruments – land taxes, land titling, land market regulations and land-related subsidies – for them to have the most positive impact possible. This line of research would bring helpful results for the design of public policies to promote economic and social development in the rural areas of developing countries.

NOTES

[1] We are aware that these agencies have recently financed or are still financing market-based access to land programs in Brazil, Colombia, El Salvador, Egypt, Guatemala, Honduras, the Philippines, South Africa and several states in India.

[2] See Kinsey (1999) in Zimbabwe, Ellis and Bahiigwa (2003) in Uganda, Ellis and Mdoe (2003) in Tanzania, and Jayne et al. (2003) in Ethiopia, Kenya, Rwanda, Mozambique and Zambia.

[3] It should be noted here that Finan, Saodulet and de Janvry (2005) find a significant impact from access to land on a complex welfare index that they construct but don't find a significant impact on total income.

[4] For good reviews on agricultural development microeconomic theories and empirical studies, see Bardhan, (1989) and de Janvry, Sadoulet and Murgai (2002).

[5] "Encuesta Nacional de Condiciones de Vida".

[6] The original ENCOVI 2000 contains 3,852 rural households. We have eliminated observations for which there is missing data, ending up with 3,796 households.

[7] Remittances are not very important, accounting for only 3% of total income (including self-consumption)

[8] Cooperative, religious group, community, female groups, etc. The idea is to try to capture organizations which are poor-specific in order to have a better control over the possible historical correlation between poor households and the agricultural sector.

[9] ENCOVI 2000 data does not include distance from each household to the closest town, but it includes this variable in the community questionnaire, which has been used as a proxy for each household. Town is defined as a place where there is a bank office and a market place.

[10] Except for the equations where the dependent variable is binary, where a probit estimation method is used.

[11] Households with more than 90 ha of land have been withdrawn in all the estimations since there are only six observations for the range from 90 to 441 ha. Results including these observations don't change the level of significance on the variables of interest, and only give slightly different coefficients.

[12] (401.195 - 8.2x1.460)/5.635 = 69; being 8.2 the average time since land is owned in the sample.

[13] That is, we ignore the "being a farmer" negative coefficient.

[14] 365 days / 5.407 US$/ha = 67.5 ha.

[15] (365 days - 183.89-8.2x1.298)/7.702 = 22 ha

[16] Upper and lower lines show 95% confidence intervals.

[17] Productive intensity is measured in Quetzales/ha, and includes the value of inputs, labour and amortization of equipment.

[18] The number of observations is smaller than the total household sample because there is some missing data.

[19] Although not reported, probit regressions where also estimated with financial savings as the independent variable, finding a negative significant correlation with being a farmer, but a non-significant negative correlation when controls were added.

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