# HOUSEHOLD INCOME, LAND VALUATION AND RURAL LAND MARKET PARTICIPATION IN ECUADOR

By

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

2008

To my family in Ecuador

ACKNOWLEDGMENTS

I thank my mom and dad for their constant love and support during this journey away from home. I also thank my husband Santiago J. Bucaram for his love, help and wisdom, and for keeping pushing me forward during the progress of this dissertation.

Special thanks I give to my chair, Dr. Carmen Diana Deere, whose valuable support made possible the completion of this research work. I thank my cochair, Dr. Ramón Espinel, as well for believing in me ever since I met him. I thank my other committee members, Charles Moss, Pilar Useche, and Grenville Barnes for appreciating the effort I put into this endeavor.

I thank the Instituto Nacional de Estadísticas y Censos (INEC) for providing me with the data set that gave place to this work at a time when it was not freely available on-line.

I give special thanks to Ing. Julia Carrión from the Sistema de Información Geográfica y Agropecuaria (SIG-AGRO) of the Ecuadorian Ministry of Agriculture for providing me with 'hard to get' geographic information which contributed to my study.

I am also thankful to Dr. Jeff Burkhardt, Graduate Coordinator, for always appreciating my work and being one of my advocates. Also to Dr. Ronal Ward for his willingness to help me understand econometric applications every time I looked for him. I also thank Dr. Andrew Schmitz for offering me the experience of publishing two papers on an interesting U.S. topic.

The Department of Food and Resource Economics deserve my appreciation for the financial assistance they made available to me, without which my Ph.D. would have not being possible.

Finally, I thank my friend Lily for her faithfulness and for providing me with a place to stay during the final stage of my dissertation.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

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August 2008

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Major: Food and Resource Economics

This research provides an economic analysis of agricultural land access at the household level and its relationship with rural markets and poverty in Ecuador. We find that land inequality and land market imperfections have a direct effect on household income per capita and that there is a synergy between these and imperfections in the labor and credit markets, which magnify the effect of land inequality on rural household income. In addition, the presence of multiple market imperfections intensifies the quasi-fixity of factors other than land, which affects the contribution of land to profits and land values. The labor advantage of small farmers explains the remarkable difference in reservation prices per hectare between small and medium and large farmers. However, this effect is reduced for credit constrained households. Lack of land titles is not found to discourage investments in land or to cause land values to be smaller than for households with tiled land.

Consistent with these findings, we also observe that the demand for land by small farmers is significantly larger than the supply of land by large landowners both in the land sales and rental markets. Small farmers are found to be more active than larger farmers on both sides of the land markets and sharecropping arrangements are found to be especially common among the

land poor. Land titles have a significant and positive effect on the likelihood to sell and similarly, credit access on the likelihood to purchase and rent in land.

We conclude that, given the difficulties that prevent desired land transfers from large landowners to the rural poor, it seems improbable that the market be able to achieve an optimal distribution of landownership without assistance from the government. Also, that for the potential benefits for rural development of increased land access to be realized, such an increase must be accompanied by better access to services so as to improve the competitiveness of the rural poor. Policies regarding the liberalization and stimulation of land rental markets and increase in the supply of credit in the rural sector are recommended.

# CHAPTER 1
# INTRODUCTION

Latin American countries, including Ecuador, are known for their severe income and land inequality. This explains the persistent interest by the region's governments as well as international development organizations in land redistribution and in enhancing land productivity in Latin America. In Ecuador, according to the 2000 agricultural census, the Gini coefficient for land was 0.8, the same as for Latin America as a whole. Land reform in Ecuador, which took place during the period 1964-79, did little to improve land distribution. More importantly, access to land via the rental market is very limited as well. According to the agrarian census, only two percent of the farms are under fixed or share-rent tenancy and 16% are under mixed tenancy (owner occupied combined with leasing or sharecropping). This is due in part to current Ecuadorian legislation which impedes the free development of land rental markets.

Though agriculture remains an important contributor to national income and a source of employment for about 30% of Ecuador's working population, agricultural policies have been deficient and unstable. In 2000, about 70% of the country's rural population earned incomes under the poverty line. It is commonly argued that an important reason for rural poverty is the limited access to land of the rural poor. On the one hand, large landholdings do not use their land intensely enough so as to generate sufficient employment opportunities for the resource poor. On the other hand, poor landowners must exploit their land more intensively than environmentally desirable, which worsens soil degradation and lowers productivity. Furthermore, not only is land ownership and access to land unequally distributed, but access to capital, technology and product markets is as well.

The land market also suffers from segmentation, where the rich trade land among the rich and the poor among the poor and where ethnicity and kinship play an important role in land

transfers, especially in the Sierra (Lambert and Stanfield, 1990). Consequently, land, credit and other market imperfections (as in the labor market) affect farm income generation and land prices, finally determining who can participate in the land market (buying, selling, renting in or renting out). In turn, low farm income and high land prices for the poor strengthen market imperfections and inequality.

Since the 1994 Land Law was approved land redistribution efforts have been left to the market. Given current restrictions on renting land, and the market imperfections just described, how well can the land market perform this task? This dissertation explores this question through the study of a national household survey data that covers all coastal and highland provinces of Ecuador.

## Objectives

The objectives of the dissertation are a) to understand quantitatively the role of land inequality and rural market imperfections on rural poverty, through an analysis of the effect of these factors on the level of household income; and b) to identify the key variables that explain the persistence of land market imperfections and inequality.

**Research question 1:** What is the effect of land inequality, land rental market restrictions, and holding untitled land on capital access and rural income generation?

**Research question 2:** In the survey year, what was the role of the land sale and rental markets (fixed or share tenancies) in land distribution and access?

a. To what extent do land reservation values reflect land quality and productivity, as opposed to inefficiencies in land and related markets (credit, labor, technical assistance) or other non-productive factors (such as holding land for status)?

b. What variables determine participation in the land sales and rental markets and the extent of participation?

## Hypotheses

**Hypothesis 1:** Market imperfections and land rental market restrictions sustain land inequality and consequently rural poverty in Ecuador.

a. In Ecuador, farm size affects household income directly and indirectly through its effect on credit access and labor allocation.

b. Land titles contribute to farm income primarily by facilitating access to credit.

c. Insecurity of property rights and restrictions on renting land out contribute to segmentation in the land rental market, hence limiting the amount of land the rural poor can access and consequently contributing to rural poverty.

**Hypothesis 2a:** Land reservation values are negatively affected by restrictions in the credit market, hence lowering the competitiveness of the rural poor in the land market.

a. Provided that small farmers are more productive (higher value product) per unit of land, the contribution of land to restricted profits (shadow land values) is decreasing in operational area.

b. Given credit market imperfections, land reservation prices per hectare are lower for credit constrained households.

**Hypothesis 2b:** Large landowners do not make land available though sales or rentals to the land poor.

a. Due to land sales after the agrarian reform, and a likely process of reconstitution of latifundia (Jordan, 2003), small farmers are more active in the land market as sellers and large landowners as buyers.

b. The land rental market is friendlier than the land sales market for the rural poor in Ecuador.

This study is divided into three main chapters. In Chapter 2 we test hypothesis 1 through the use of a theoretical model which shows the effect of one more unit of land on household income when there are multiple market imperfections. Descriptive and econometric analyses add to the discussion and corroborate such effects. Hypothesis 2a is tested in Chapter 3 by analyzing the configuration of land values. First, this chapter presents the estimation of a restricted profit function and land shadow values. It then categorizes households into credit constrained and

credit unconstrained and uses these pieces of information in the estimation of land reservation prices per hectare. Graphic analysis helps understand how land values per hectare vary with farm size. Chapter 4 studies hypothesis 2b using descriptive analysis of household participation in the land sales and rental markets and econometric estimations which highlight the variables that influence the likelihood to sell, purchase, rent out or rent in land (as well as the amount of land involved in each type of transaction). Here we analyze the role of the land market as a channel for land redistribution. Finally, Chapter 5 offers general conclusions as well as policy recommendations.

CHAPTER 2
THE IMPACT OF LAND INEQUALITY ON ECUADORIAN HOUSEHOLD INCOME

## Land Problems and Rural Poverty

According to the last agricultural census (2000) in Ecuador, the Gini coefficient for land was 0.8 (with 1.0 being equal to perfect inequality), similar to that of Latin America as a whole, the region with most unequal land distribution in the world.[1] The agricultural census shows that 64% of the total 843,000 agricultural production units in Ecuador are of less than five hectares in size and farm only 6.3% of Ecuador's total cultivable land. On the other hand, 6.4% of all productive units each hold 50 or more hectares for a total of 61% of the agricultural land.

Land reform in Ecuador, which took place during the 1964-79 period, did little to improve land distribution (Otáñez et al., 2000; Chiriboga and Rodriguez, 1998).[2] More importantly, access to land via the rental market is very limited as well. According to the agricultural census, only 2% of the farms are under fixed or share-rent tenancy and 16% are under mixed tenancy (owner occupied combined with leasing or sharecropping).[3] This is due in part to current Ecuadorian legislation which prevents the free development of land rental markets.[4]

Though agriculture remains an important contributor to national income and a source of employment for about 30% of Ecuador's working population, agricultural policies have been deficient and unstable. In 2000, about 70% of the country's rural population earned incomes

[1] Hayami and Otsuka (1993) show that the Gini coefficient for operational farmland distribution in Latin America is higher than 0.8, much larger than the coefficient for developing countries in Asia. Also, de Ferranti et al. (2003) note that income as well as asset inequality is higher in Latin America and the Caribbean than in Asia, Eastern Europe, and the 30 countries of the Organization for Economic Cooperation and Development. Average Gini coefficients from 1966 to 1990 (obtained by Deininger and Olinto, 2000) are 0.81 for Latin America while those for the Middle East, North and Sub-Saharan Africa, and East and South Asia are all lower than 0.7.

[2] Chiriboga and Rodriguez (1998:16) note that, compared with the agrarian reform experience of other countries in the region, Ecuador is among those with the least redistributive results.

[3] In contrast, in Asia some 20 to 30% of the land is rented, in the United States, 40%, and in Belgium, 67% (FAO, 2002).

[4] Legal and normative types of limitations in the land rental market are addressed in Section IV below.

under the poverty line. More specifically, the 1998-1999 Living Standard Measurement Survey shows that 50% of agricultural households in the sample had an annual income equal to or smaller than $1,300; 75% reported incomes smaller than $2,500 and 99% indicated incomes of less than $15,000. The average annual income of agricultural households was close to $2,000, which represents only 46% of the mean annual income of the total sample of households (5,816 households).[5] Since the agricultural portion of the sample (1,898 households) represents mostly non-urban households (90%), this is an indicator that rural poverty is more severe than urban poverty,[6] a finding that is common in developing countries.

It is commonly argued that an important reason for rural poverty is the limited access to land of the rural poor. On the one hand, large landholdings do not use their land intensely enough so as to generate sufficient employment opportunities for the resource poor. On the other hand, poor landowners must exploit their land more intensively than environmentally desirable, which worsens soil degradation and lowers productivity. Furthermore, not only is land ownership and access to land unequally distributed but access to capital, technology and product markets is as well.

In addition, the land market in Ecuador suffers from segmentation, where the rich trade land among the rich and the poor among the poor and where ethnicity and kinship play an important role in land transfers, especially in the Sierra (Lambert and Stanfield, 1990). According to the literature, land market segmentation is encouraged by land insecurity or little protection of property rights (Marcours et al. 2005; FAO, 2002) and by high effective land prices

[5] The year of our survey data (October 1998- September 1999) represents a time of severe economic crisis in Ecuador, just before the 'dollarization' of the economy (which officially took place in January, 2000). Yet, that should not be considered an abnormal year in terms of poverty since poverty had already been on the increase and continued increasing in the following years.

[6] Similarly, a FAO country profile for Ecuador based on year 2004 reports an agricultural per capita GDP (agricultural GDP/agricultural population) that represents only 40.5% of national per capita GDP.

for the poor, beyond the productive ability of the land, driven by imperfect capital markets and the existence of high transaction costs in the land market (Carter and Salgado, 2001; Carter and Zegarra, 2000). In addition, low farm income and high land prices for the poor strengthen market imperfections and inequality. As argued by de Janvry et al. (2001), under multiple market imperfections like these, improving land access for the poor can improve both welfare and efficiency.

The objective of this chapter is to understand quantitatively the role of land inequality on the level of rural household income, at the same time as we explore the hypothesis that market imperfections and land rental market restrictions sustain land inequality and consequently rural poverty in Ecuador.

The development literature has already addressed in different ways the effects of farm size and unrestricted land rental markets on farm income. This has been empirically analyzed in several countries of the developing world; however, the results tend to vary from country to country, or even within the same country, depending on the variables included in the analysis. Moreover, previous studies of these issues in Ecuador have been only partial, limited to certain sub-regions or variables. This study, which covers a sample of farm households from all provinces of the coastal and highland regions of Ecuador (an area that represents 77% of Ecuador's cultivable land), will provide a comprehensive analysis of these issues.

This chapter is organized as follows: First, we summarize the importance of market imperfections in household utility maximization. Then, in order to test for the existence of a relationship between farm size and 1) credit access, 2) value product per unit of labor, 3) labor allocation and 4) value product per unit of land, we perform pair wise analyzes based on our household data. Subsequently, we provide a brief description of the land rental market situation

in Ecuador and its possible influence on poverty. Then, we model the effect of additional land on income for an average agricultural household, followed by an econometric estimation of household income per capita to test for the effect of farm size and credit access among other relevant variables. We offer conclusions in our last section.

Our results suggest that land inequality and land market imperfections have a direct effect on household income per capita but also that there is a synergy between these and imperfections in other markets such as credit and labor, which are essential for agricultural production and productivity. These imperfections magnify the effect of land inequality on household income.

## Multiple Market Imperfections and the Household Income Problem

The agricultural sector of developing countries suffers from multiple market imperfections, including the credit, insurance, labor and land markets. Development economists (Singh, et al., 1986; Bardham and Udry, 1999) have observed that multiple market imperfections invalidate the classical profit maximization approach used in order to find (or understand) optimum input allocation of rural households.

More specifically, models of profit maximization assume that production decisions are independent of consumption decisions such that input choice depends only on input and output prices and the available technology (Bardham and Udry, 1999). Under this condition, the farm household's problem is separable and can be solved recursively: production decisions are made first (profit is maximized) and consumption decisions afterwards (thus utility of consumption can be maximized subject to a budget constraint that includes taking maximized profits as a given). This implies that production decisions affect consumption decisions but not vice versa. In other words, preferences (e.g. between consumption and leisure), household endowments (e.g. assets and labor), non-farm income and prices of consumption commodities do not affect production decisions (Singh, et.al., 1986, Bardham and Udry, 1999).

This structure, however, applies only when markets are complete or when there is only one market imperfection, not when there are multiple market imperfections (Bardhan and Udry, 1999). In order to reach equilibrium, households must equate demand and supply for each commodity. The non-existence or incomplete presence of markets impede this equilibrium to happen at market prices, instead it happens at what are called virtual or shadow prices which are different from market prices and are endogenous to the household (Singh et at, 1986).

Virtual prices and consequently the farmer's maximization problem will be a function of household endowments, such as land and family labor; market prices; off-farm labor market characteristics and non-farm income, among other factors. Therefore, the appropriate agricultural household model under multiple market imperfections is that which jointly considers production and consumption choices (Bardham and Udry, 1999).

According to this analysis, land inequality or rather an improvement in land distribution would influence input choice (including allocation of family labor), hence having the potential of affecting farm productivity and household income as a result. The model below develops this idea following Finan et al. (2005); first, we perform pair wise descriptive analyzes with our household data in order to observe if and how significantly farm size affects credit access, labor allocation and labor and land productivity in the case of Ecuador.

## Statistical Analysis

We use data from Ecuador's Living Standard Measurement Survey (LSMS) 1998-99 provided by the National Institute of Statistics and Census of Ecuador, in order to empirically observe the effect of land access on credit and farm labor. The sample includes 5,816 urban and rural households from the Coast and Sierra regions of Ecuador; 1,898 observations of agricultural households are used in this chapter. Relevant sections of the survey include questions on economic activities of the household members, credit access, land tenure,

agricultural production, farm labor, variable input expenses, and ownership of machinery and equipment as well as household demographics. Here, we perform pair wise analyses of credit access, labor allocation and labor and land productivity with respect to farm size.

The analysis below will classify farms in four categories based on farm size. The first category consists of operational holdings of less than 1 hectare. These are considered *minifundios* since such small farm sizes hardly allow for the subsistence of a household. These farms are treated as a separate category here given their predominance in the sample (the national agrarian census also reports these farm sizes as a separate category). The next category, farms of one to less than five hectares are still considered small and, as noted by Lopez and Valdez (2000), "If not irrigated and intensively farmed …this amount of land cannot support levels of consumption above the extreme poverty line without other sources of income (Lopez and Valdez, 2000: 203)."

Farms of five to less than 40 hectares are regarded as medium size given their higher probability of being medium capitalized units, that is, units belonging to farmers who have been successful in agriculture and have been able to accumulate land (or access more land) and other assets over the years. Finally, farms larger than 40 hectares are treated as large. Table 2-1 summarizes this information.

Similar to the data gathered by the national agrarian census, Table 2-1 shows that the largest category is made up by *minifundios* and that the majority of farm households operate less than 5 hectares. Moreover, the median operational holding is less than 2 hectares.

Of the total number of farms in our sample, 73.8% are reported as owner-operated; 15.5% are partially owner-operated, and 10.6% are held by tenants only.

**Credit Access**

The dependency of credit access on land wealth is a well known constraint in the developing world where dualistic structures[7] characterize the rural sector (Bardhan and Udry, 1999; Carter and Zegarra, 2000; Feder and Feeny, 1993). Besides the fact that collateral is usually necessary in order to access the formal credit market, and that land is the most desirable type of collateral given its characteristics, land ownership is a sign of economic -and at times political- power which facilitates market immersion and participation (de Ferranti et al., 2003). We explore the existence of a relationship between credit access and farm size in the case of Ecuador. Table 2-2 shows the proportion of farm households classified by operational area who obtained credit for a positive interest rate.[8] The proportion of loans received from the formal sector and those from the informal sector are also reported together with the respective credit amounts and interest rates.

The credit variable is total credit received by the household, which includes credit for agriculture, for a family business and/or for consumption (purchase of durable goods, house building/remodeling, sickness, etc.). The reason for including all types of credit received by the household is that since credit is fungible it can be used on any household need regardless of the purpose for which the loan was obtained. Besides, ownership of/access to land (which is our focus here) is a signal to lenders as to how much debt responsibility a household can acquire. Thus we expect to find a relationship between farm size and credit access even if we include

[7] A dualistic structure in the rural sector refers to low productive small family farms coexisting with capitalist farmers who hire labor and where the mobility of farm operators between the two sectors is severely limited (Berry and Cline, 1979; Bardhan and Udry, 1999).

[8] Households who received credit for a null interest rate are omitted for purposes of this analysis since such cases often involve small loans provided by relatives or friends, or credit received in-kind by input suppliers or NGOs.

loans for family business or consumption. The interest rate (r%) is the average nominal interest rate faced by the household including all types of credit.

The chi-square statistic for the hypothesis of independence between operational farm size and credit access (null hypothesis) reveals that there is a statistically significant relationship between the two variables (the null hypothesis is rejected at 5% level of significance). The null hypothesis is also rejected (at 10% level of significance) when owned farm size is used instead of operational farm size.

The same test was performed for the case of formal credit, in which the independence hypothesis between farm size and credit access was rejected at a 10% level of significance. We also tested the hypothesis for access to informal credit but this time there was a failure to reject. This result suggests that, as expected, non-institutional lenders pay less attention to farm size than formal lenders since the former tend to be much more familiar with their borrowers, hence, facing lower levels of imperfect information.

Also, statistical analysis of the relationship between category of farm size and the type of credit obtained (formal vs. informal) reveals that such a relationship is significant for *minifundistas* (5% significance) and small farm sizes (1% significance), with the odds of getting informal credit being higher than the odds of accessing formal credit.[9] For medium and large size farmers formal and informal sources of credit are more equally accessible (and/or preferred) than for *minifundistas* or small farmers.

In addition, when analyzing the difference in the amount of credit obtained from formal and informal sources, using a t-statistic we find that, although the amounts of formal credit are greater for all operational sizes, the difference is only statistically significant for the small size

[9] The data indicate that a *minifundista* is 75% more likely to get informal credit than formal credit. The likelihood for small farmers is 164%.

category. However, taking all sizes together (Table 2-3), the mean dollar amount of formal credit is significantly larger than the mean dollar amount of informal credit.

Analysis of the interest rates reveals that, except for the large farm size category (Table 2-2), informal credit interest rates are significantly higher than formal credit interest rates. This is in line with what was expected given the theory and typical empirical findings (for example see Andersen and Malchow-Moller, 2006).

A somewhat intriguing finding in Table 2-3 is that only 20% of all formal loans required real estate as collateral (compare this to 58% in Peru in 1997 as reported by Guirkinger and Boucher, 2005). This, however, can be explained by observing the structure of the formal credit market in our sample. The bulk of formal credit is offered by private banks (33%) and cooperatives and associations (49%) and the rest by governmental institutions (11%) and NGOs (7%). The latter institutions typically not require borrowers to put real estate as collateral. Similar is the case of cooperatives and associations. Finally, although private banks would be expected to act differently than the other lenders, asking for valuable collateral such as real estate, the evidence indicates that the loans offered by banks in the rural sector are in general small compared to those offered in the urban sector (Espinel, 2002); this could explain the little need for this type of collateral.[10] This result together with our findings of a statistically significant relationship between farm size and credit access suggests that land ownership is not necessarily functional as collateral for formal credit but it is also a sign of economic power which facilitates credit access.

[10] The average amount of credit received from private banks in the sample is US$2,143.

**Value Product per Unit of Labor**

Evidence in developing countries has also shown that there is a direct relationship between farm size and value product per unit of labor (usually referred to as labor productivity). Our data conform to what is expected (Table 2-4).

While all farm sizes reported the use of non-remunerated labor, medium and large farmers hired a significantly larger amount of labor than *minifundistas* and small farmers (Table 2-4). Larger amounts of hired labor reflect the capitalist nature of medium and large farmers, which is manifested in higher labor productivity. Capitalist farmers hire labor up to the point where marginal labor productivity equals the wage rate, while traditional family farms usually have larger amounts of labor per unit of land which, given labor and credit market imperfections, they must allocate less efficiently to the farm (Berry and Cline, 1979).

More specifically, since moral hazard and hence the need for labor supervision is not an issue when using family labor while it is when hiring labor, family labor tends to be more productive than hired labor (Binswanger et al., 1993); however, the presence of imperfections in the labor and credit markets (i.e. unemployment and credit rationing) cause small farmers to make a less efficient allocation of labor to the farm compared to larger farmers, resulting in lower value product per unit of labor for small farmers.

The t-tests of mean differences indicate that the most significant [consecutive] difference in productivity occurs between medium and large size farmers (10% significance). However, the differences in productivity between a *minifundista* and a medium size farmer and between a small and a large farmer are highly significant (1% significance). Differences in mean labor productivities for the four different categories of farm sizes can be better observed in Figure 2-1, which shows a clear increase in mean labor productivity as farm size increases.

**Labor Allocation**

Table 2-5 shows the distribution of the primary activity of household heads and the composition of household income by agricultural and non-agricultural sectors for each category of farm size.[11] Table 2-5 illustrates that as farm size increases so does the proportion of household heads who primarily work on-farm. Similarly, considering total household income, it is more likely that farming is the main source of income for the household as farm size increases. Also, both *minifundistas* and small farmers rely more heavily on wage income (either from the agricultural or non-agricultural sector) than medium and large farmers. Our data thus suggests that as farm size increases so does the importance of the farm business for the household, resulting in a higher level of income obtained from agriculture (compared to other sources of income of the household).

Taking into account the sex of the household heads, 16% of them are women. They are over-represented among *minifundistas* and under-represented among small and medium farmers (Table A-1). Of the household heads who are not economically active, these are slightly more likely to be female rather than male (53 vs. 47%). Also, female heads are more likely to declare agricultural self-employment as their primary activity than male heads (55 vs. 45%). The female heads most likely to declare agricultural self-employment as their primary activity are smallholders and large farmers.

**Value Product per Unit of Land**

The hypothesis of an inverse relationship between farm size and the value of total product per hectare (usually referred to as land productivity), often found in the developing world, is also

[11] The decomposition of rural household income follows Corral and Reardon (2001).

tested here using pair wise analysis. Table 2-6 presents the mean land productivity for each group of farm size.

The t-tests of mean differences in land productivity show that the difference in mean value product per hectare between farm size categories is statistically significant at a 5% level of significance, indicating that small farmers tend to exploit the land more intensively than large farmers. This result was expected given that, as noted earlier, small farmers usually have a larger labor to land endowment ratio than large farmers (Berry and Cline, 1979), hence output per hectare tends to decrease with farm size.

## The Land Rental Market

It has been argued that land ownership should not necessarily be the main objective in order to improve the livelihood of the poor, but that access to land via other forms of tenure, friendlier to the poor, should be earnestly sought too (de Janvry et al., 2001; Sadoulet et al., 2001, and Currie 1981). In accordance with this idea, international development organizations advocate for liberalization of the land rental markets in developing countries. This process could be considered to be only half-way implemented in Ecuador because of legal as well as normative types of limitations.[12] Among the legal limitations are the following:

a) Sharecropping, a form of tenure that, although regarded as inefficient by some authors, has proved effective in overcoming imperfections in the capital and labor markets, was abolished in 1970 by the "Law of abolition of precarious forms of labor in agriculture", and it continues to be illegal.

b) Fixed-rent tenancy is allowed by the law but the law also contemplates the possibility of prescription of the owner's property rights under certain conditions, namely, 1) if the landowner does not have a valid land title (properly registered), he/she can easily loose the land to their tenant; or 2) even in the presence of a valid land title by the owner, if the rental agreement is not in the form of a written contract properly registered, and if the tenant has been the land operator for at least 15 years, the landowner's property rights can be prescribed.

[12] Based on FAO (2002) study.

c) The Constitution still includes the possibility of expropriation based on the concept of the social function of the land (art. 30).[13]

This legislation conserves the spirit of the agrarian reform era; it gives more protection to tenants than to landlords and discourages supplying land to the rental market. In addition, normative conditions that hinder the rental market are as follows:

d) High transaction costs discourage land title registration by landowners;

e) Proliferation of land conflicts (due to conflicting inheritance rights or lack of titling);

f) Lack of knowledge about the relevant legislation and abundance of corrupt lawyers who increase the costs of legal processes;

g) Lack of formal enforcement of property rights; and

h) Unequal ethnic and socioeconomic relations

Points (d) and (e) reflect the impediments landowners face in order to obtain land title and consequently to satisfy requirements of the law in order to engage in formal rental contracts. Conditions (f) through (h) point to the high risk of losing property rights that landowners would face if they decide to rent-out their land. This analysis would explain the low incidence of land rental agreements in Ecuador reported by the agrarian census (see the first section of this chapter).

As a consequence, it has been found that land rental markets in Ecuador are segmented (Lambert and Stanfield, 1990; FAO-COTECA, 1995; FAO, 2002). Landowners prefer tenants they already know and can trust and vice versa, hence the more economically powerful rent among themselves and so do the poor, with the ethnic component being of importance too.[14] This alone suggests that the landless poor would at best be able to access land of the poor, which

[13] Causes for expropriation are precarious forms of farm labor; technologies of production that endanger natural resources; abandoning farming for more than two consecutive years; and lands that, while not fulfilling their social function, face demographic pressure by peasant populations.

[14] Lambert and Stanfield (1990) and FAO-COTECA (1995) note that land sale markets are also segmented by class and ethnicity.

given the potential effect of farm size on poverty, would imply both that the amount of land they could access is small and that they would continue to be poor. This implication is strengthened by the previous analysis on credit access and labor productivity, which are influenced by farm size.

Finally, our data (Table 2-7) indicates that the large majority (84%) of tenants (either tenants only or farmers that combine farming their own and rented land) are either *minifundistas* or small landholders. Given land concentration in the hands of large landowners, it is the land poor who usually engage in the rental market. Although we lack data on whom the tenants in the sample rented from, the findings about land segmentation of the studies already mentioned lead us to expect that these tenants likely rented from small farmers.

## The Model

The model we developed has its roots in the agricultural development literature (Bardhan and Udry, 1999; Feder and Feeny, 1993; Finan et al., 2005) and has been adapted to fit the situation faced by a representative farmer in Ecuador as observed in our 'statistical analysis' section. The purpose of this model is to show the effect that an additional unit of land would have on total household income.

This model illustrates the optimization process of an average agricultural household when choosing productive inputs. Three market imperfections are considered here: incomplete land markets, dependency of formal credit on land wealth, and unemployment. The first market imperfection reflects the fact that -as argued in the previous section- land markets in Ecuador are segmented, hence demand for land by the poor or marginalized segments can only be partially satisfied. Under these conditions, land purchases by the average household and even access to land via the rental market can be regarded as unimportant for the purpose of this model.

Therefore, following Finan et al. (2005), we ignore land transactions and consider land as exogenous.

The second market imperfection occurs because costs of information and [consequently] of repayment enforcement limit the ability of institutional credit to reach small farmers (Feder et al., 1988). As a result, these farmers are rationed in the formal credit market, while this is generally not the case for large farmers. Hence, different from perfect capital markets, borrower risk is not necessarily the cause of borrower rejection (since institutional lenders do not have information on how risky a specific small farmer is); instead, the borrower's farm size is. This is supported by the findings in our 'statistical analysis' section which show that there is a statistically significant relationship between farm size and formal credit access and that the mean dollar amount of formal credit is significantly higher than the mean dollar amount of informal credit. Informal credit is thus ignored in this section.

Finally, unemployment is also a crucial problem in Ecuador. In 1998-1999 national unemployment reached between 11 and 14%[15] (Instituto Nacional de Estadísticas y Censos, INEC), among the highest rates in Latin America and the Caribbean (ECLAC, 2005: Table 1.2.17). This is an important constraint for household income maximization since, together with incomplete land markets, unemployment produces inefficiencies in the allocation of family labor, which is reflected in low farm-labor productivity (Berry and Cline, 1979). Moreover, segmentation of land markets is encouraged by imperfections in the credit markets since limited access to capital cannot easily make up for poor households' liquidity constraints enough so as to purchase larger units of land (Carter and Salgado, 2001).

[15] Although 14% was the highest unemployment rate between 1990 and 2006, rates were in average 10% annually between 2000 and 2006 (*INEC*).

The assumptions in this model are the following: 1) no land transactions or land rental contracts; 2) hired and family labor are perfect substitutes, and 3) off-farm wage equals the wage earned by hired farm labor. Two limiting conditions are of importance: a budget constraint and a labor market constraint. The budget or cash constraint includes the additional limitation that the amount of credit that can be borrowed depends on the household's total land endowment.

For our model, a household is expected to maximize returns to its fixed assets (land and family labor) –income that will be used for consumption and savings. Income for the agricultural household comes mainly from three sources: farm profits, off-farm wage income, and non-labor income -which would include remittances, governmental transfers and income from investments- minus the cost of borrowing[16].

$$\underset{L_f, L_m, H, X}{Max} \quad pQ(A, L, X; y) - wH - qX + wL_m + R - iD(A)$$

$$\begin{aligned} s.t. \quad & L = L_f + H \\ & wH + qX \leq wL_m + R + D(A) \qquad (2\text{-}1) \\ & L_m \leq M \quad ; \quad L_m + L_f = E \\ & H \geq 0 \end{aligned}$$

Where,

- $Q$ = total farm output
- $A$ = land endowment
- $E$ = family labor endowment
- $L_m$ = off-farm labor supply
- $L_f$ = on-farm family labor
- $H$ = hired labor
- $M$ = maximum amount of labor hours the labor market can accept from the household
- $X$ = variable inputs
- $y$ = household and farm characteristics (human capital, farm location, soil quality, etc.)

[16] Total debt value cancels out in the objective function since the household repays the same amount of money it receives; the only thing left to affect its income is the cost of borrowing.

- $R =$ non-labor income
- $D =$ amount of credit received by the household
- $p, q, w, i =$ output price, input price, wage rate, interest rate

The Lagrangean is represented by the following equation:

$$\begin{aligned}\zeta = {} & pQ(A, L, X; y) - wH - qX + w[E - L_f] + R - iD(A) + \\ & \mu_1\{w[E - L_f] + R + D(A) - wH - qX\} + \mu_2[M - E + L_f]\end{aligned} \tag{2-2}$$

Kuhn Tucker conditions:

$$\frac{\partial\zeta}{\partial L_f} = pQ_{L_f} - w - \mu_1 w + \mu_2 \le 0; \quad L_f \ge 0; \quad L_f[pQ_{L_f} - w - \mu_1 w + \mu_2] = 0 \tag{2-3}$$

$$\frac{\partial\zeta}{\partial X} = pQ_X - q - \mu_1 q \le 0; \quad X \ge 0; \quad X[pQ_X - q - \mu_1 q] = 0 \tag{2-4}$$

$$\frac{\partial\zeta}{\partial H} = pQ_H - w - \mu_1 w \le 0; \quad H \ge 0; \quad H[pQ_H - w - \mu_1 w] = 0 \tag{2-5}$$

$$\frac{\partial\zeta}{\partial \mu_1} = w[E - L_f] + R + D(A) - wH - qX \ge 0; \quad \mu_1 \ge 0; \quad \mu_1\{w[E - L_f] + R + D(A) - wH - qX\} = 0 \tag{2-6}$$

$$\frac{\partial\zeta}{\partial \mu_2} = M - E + L_f \ge 0; \quad \mu_2 \ge 0; \quad \mu_2[M - E + L_f] = 0 \tag{2-7}$$

Since the households being modeled are agricultural producers, $L_f$ and $X$ should be positive.

Now, if $H > 0 \Rightarrow pQ_H = w(1 + \mu_1)$.

From (2-3), $pQ_{L_f} = w(1 + \mu_1) - \mu_2 \Rightarrow pQ_H = pQ_{L_f} + \mu_2 \Rightarrow \mu_2 = pQ_H - pQ_{L_f}$. Since family and hired labor are assumed equally productive (assumption 2), then $\mu_2 = 0$. This implies that when $H > 0$ the labor constraint is not binding ($L_m < M$); in other words, the household would not be suffering from unemployment. In such a case and assuming the financial constraint is binding,[17] the indirect (or maximized) household income function ($F$) would be as follows:

[17] This assumption is based on the fact that credit is scarce in rural areas.

$$F = \Phi(p, q, w, i, A, E, R; y)$$
$$= pQ(A, L^*, X^*; y) - H^* w - X^* q + w[E - L^*_f] + R - i\{wH^* + qX^* - w[E - L^*_f] - R\} \quad (2\text{-}8)$$

In order to observe the effect of one more unit of land on the optimal choices of inputs and consequently on total household income, let us obtain the total derivative of household income with respect to land.

$$\frac{dF}{dA} = pQ_A + [pQ_{L_f} - w(1+i)]\frac{\partial L^*_f}{\partial A} + [pQ_H - w(1+i)]\frac{\partial H^*}{\partial A} + [pQ_X - q(1+i)]\frac{\partial X^*}{\partial A} \quad (2\text{-}9)$$

This is equivalent to (from the first order conditions):

$$\frac{dF}{dA} = pQ_A + w[\mu_1 - i]\frac{\partial L^*_f}{\partial A} + w[\mu_1 - i]\frac{\partial H^*}{\partial A} + q[\mu_1 - i]\frac{\partial X^*}{\partial A} \quad (2\text{-}9)'$$

Provided that $\mu_1 - i > 0$, which is the case for credit constrained households,[18] we see that an increase in land endowments contributes to household income both directly through affecting total production and indirectly through an effect in the optimal choice of farm labor, hired labor and variable inputs.

On the other hand, if $H = 0 \Rightarrow pQ_H - w < \mu_1 w$. From (2-3) we have $\mu_1 w = pQ_{L_f} - w + \mu_2$. Replacing $\mu_1 w$ in the previous equation and solving for $\mu_2$ we get $\mu_2 > pQ_H - pQ_{L_f}$. This suggests $\mu_2 > 0$, which implies that the labor market constraint would be binding ($L_m = M$). In other words, the household cannot send any more members to off-farm labor, therefore it must use all its labor on-farm and neither would it need hired labor nor could it afford it. This result is more appropriate for an average agricultural household in Ecuador, where the labor constraint is

[18] The Lagrange multiplier for the budget constraint, $\mu_1$, represents the shadow value of capital. For households who are credit constrained, this shadow price is larger than the market interest rate (Cater and Salgado, 2001).

very likely to be binding, hence little or no hiring is done.[19] The maximized household income would in this case be (again assuming $\mu_1 > 0$):

$$\begin{aligned} F &= \Lambda(p, q, w, i, A, E, K, y) \\ &= pQ(A, L^*_f, X^*; y) - q[1+i]X^* + w[1+i]M + [1+i]R \end{aligned} \tag{2-10}$$

The effect of an increase in the land endowment would be

$$\frac{dF}{dA} = pQ_A + pQ_L \frac{\partial L^*_f}{\partial A} + \{pQ_X - q[1+i]\}\frac{\partial X^*}{\partial A} \tag{2-11}$$

$$\equiv \quad pQ_A + [w(1+\mu_1) - \mu_2]\frac{\partial L^*_f}{\partial A} + q[\mu_1 - i]\frac{\partial X^*}{\partial A}$$

From the family labor first order condition we can see that if $\mu_1 = 0$ and $\mu_2 > 0 \Rightarrow$ $\mu_2 = w - pQ_{L_f} > 0 \Rightarrow w > pQ_{L_f}$. Hence, given the labor market restriction, the productivity of on-farm labor is smaller than off-farm wage labor (this is what causes no hiring to be chosen). Because of the labor market imperfection then, even if capital markets were perfect, the shadow value of land for the household would be greater than simply the direct effect of land on farm product.

Now, if both $\mu_1 > 0$ and $\mu_2 > 0 \Rightarrow \mu_2 = w(1+\mu_1) - pQ_{L_f} > 0 \Rightarrow w(1+\mu_1) > pQ_{L_f}$. That is, labor productivity is smaller than the wage rate times one plus the shadow value of capital. Thus, one more unit of land would have an even larger effect on household income than if credit markets were not constrained.

In Equation 2-7 we see that one of the ways in which one more unit of land will contribute to household income is by allowing it to relocate labor between on- and off-farm activities (similar to what was observed in Table 2-5), however this effect will remain smaller than

[19] Our data shows that less that 30% of small farmers (less than 5 hectares) did any hiring in their farms; less than 3% used more hired than non-remunerated labor, and less than 1% used only hired labor.

$w(1+\mu_1)\frac{\partial L^*_f}{\partial A}$ as long as the labor market constraint is binding ( $\mu_2 > 0$ ). In other words, inefficiency in labor allocation will continue given the labor market imperfection. However, since $L_m = E - L_f$, the more $A$ increases, the smaller the labor market constraint for the household (the constraint could go from binding to non-binding) and the closer $pQ_{L_f}$ to $w(1+\mu_1)$. Hence, increases in the land endowment should improve labor allocation and, consequently, productivity (assuming that farm labor skills are standard for all family members).

Our results therefore suggest that imperfections in the credit, land and labor markets affect farm labor and input allocation, inducing low productivity and hence worsening rural poverty. In turn, a poor, low productivity farmer has limited access to credit and land markets. Since this type of producer makes up the great majority in rural Ecuador, inequality in the ownership of land (and lack of access to land in general) is therefore strengthened and so is poverty. Additional land alone would not necessarily turn smallholders into efficient, modern entrepreneurs as many land reform experiences across Latin America have shown. In order to raise agricultural incomes, reforms in complementary markets are essential.

In the next section, we proceed to estimate the effect of farm size, credit and labor on household income per capita.

## Household Income Per Capita Estimation

From the previous sections we see that land is expected to affect household income both directly and indirectly through its effect on credit access, labor and input allocation. Hence, we need to deal with an endogeneity problem when attempting to estimate the effect of these variables together with farm size on household income. In order to perform a consistent estimation, two-stage least squares (2SLS) estimation is used, where a credit regression is

performed first, followed by a household income regression. In the household income estimation a prediction of the credit variable from a censored Tobit is included and both the value of inputs and intermediate assets eliminated. This is because credit would have been likely used in part for the purchase of non-labor inputs (fertilizers, seeds, etc.), machinery and equipment. In addition, we run a probit regression for access to credit prior to our Tobit analysis with the purpose of confirming what variables should be included in the latter.

The system to be estimated is the following (Table 2-8 defines each variable and Table 2-9 summarizes all variables included).

$$\begin{aligned} HIPC = {} & \beta_0 + \beta_i County + \beta_i Periphery + \beta_i Settlement + \beta_i Disperse + \beta_i LandQual \\ & + \beta_i Male + \beta_i Age + \beta_i Edu + \beta_i AdultsPC + \beta_i SizePC + \beta_i SizePC^2 + \beta_i Tenant \\ & + \beta_i CreditHatPC + \beta_i TechAsist + \beta_i \%HiredLabor + \beta_i OffIncome + \beta_i Rmt + \xi \end{aligned} \tag{2-12}$$

$$\begin{aligned} Credit = {} & \alpha_0 + \alpha_i Province + \alpha_i NonUrban + \alpha_i AgCon + \alpha_i XCrops + \alpha_i Male + \alpha_i Age \\ & + \alpha_i Edu + \alpha_i Size + \alpha_i Size^2 + \alpha_i NPlots + \alpha_i Owner + \alpha_i \%Title + \alpha_i Formal \\ & + \alpha_i Formal * Title + \alpha_i Assets + \alpha_i Animals + \alpha_i OffFarmInc + \alpha_i NonLaborInc + u \end{aligned} \tag{2-13}$$

Given differences between the Coast and Sierra regions in climate, production and agricultural land distribution (the smallest farm sizes are mainly found in the Sierra), two systems are estimated, one for each region.

Like in Table 2-5, our income variable includes all sources of annual household income, namely wage income, net monetary income from self-employed members (either in agricultural or non-agricultural activities),[20] other sources of income such as rents, interests, pensions, etc., and non-labor income coming from remittances, governmental and/or non-governmental monetary transfers.

[20] Net income from self-employed members has been calculated using individuals' reported estimate of annual monetary income.

The variable farm size refers to operational land holdings. As noted earlier, because of restrictions in the labor market, more land in operation implies more employment absorption of family labor and more income possibilities. This is so regardless if the land is owned or rented-in. Also, given results in our 'statistical analysis' section, this variable is expected to influence credit access and the amount of credit obtained. The sign, significance and relative magnitude of the effect of farm size on Equations 2-12 and 2-13 are the main focus of our analysis since they will allow us to test for the effect of land inequality on poverty. On Equation 2-13, this variable will indicate how limited small farmers are with respect to access to services and on 2-12, it will show the development potential that larger operational holdings would have for individual households.

The tenure variable is also of special importance in the household income equation. It will gather whether or not land ownership makes a difference on household income compared to tenancy. An aspect closely related to the importance of land wealth on access to credit is the role of a land title. More specifically, if land ownership facilitates participation in the formal credit market, then those who have title to their land should be preferred by lending institutions (the interaction term between formal credit and title to land will help capture this effect). However, if only farm size but not land title had a significant effect on credit access that could suggest a rather indirect effect of farm size on credit access (Table 2-3).

Farm machinery and equipment (assets) ensure better productivity of land and labor and therefore could influence credit access. In addition, machinery can be used as collateral for credit. The value of owned animals is included too because empirical studies have shown that farmers often use livestock as a form of savings in addition to their sometimes being means of

farm work. Specially for accessing informal credit, ownership of livestock or small animals can be an implicit type of collateral[21].

The effect of household location is expected to be captured by several variables in each region. Location in an urban or non-urban (periphery, settlement or disperse) sector represents distance from major markets. Also, since land distribution and productive conditions differ by county (Lambert and Stanfield, 1990; FAO-COTECA, 1995; World Bank, 2004), county dummies are included in the household income equation (Equation 2-12).

For the credit equation (Equation 2-13), we added province dummies. The province with mean income closest to the mean income of the Sierra is Cañar and that for the Coast is Los Rios; thus these provinces are chosen as a base for comparison in each region. We also included a dummy indicating whether or not the household is located in an area of agricultural concentration or in an area of concentration of export crop production. If the household is located in an area of agricultural concentration, it is likely to have better access to productive services (marketing channels, variety of lenders), hence having better possibilities of accessing credit. Due to data limitations, agricultural concentration is assumed at the county level, more specifically, if a household is located in a county in which over 50% of the land is being exploited[22] it is considered to belong to an area of agricultural concentration. Likewise, if a household is located in an area of major production of export crops such as bananas, cocoa, coffee or flowers, then it is considered as belonging to an area of export crop concentration.

In order to capture the effect of operational holdings distributed in more than one farm, the variable *NPlots* was introduced in Equation 2-13. The fact of having two or more plots in

[21] The word 'implicit' is chosen because in our sample there are no cases of animals explicitly pledged as collateral for credit.

[22] This includes fallow lands and shrimp pools and excludes the area of moorlands, mountains, forests and infrastructure.

operation could have two opposite effects for farmers when trying to access credit: 1) the possibility of benefiting from economies of scale is reduced, hence lenders might be less willing to offer credit to a small farmer with several plots; and 2) the risk of loosing a harvest is reduced by not having production concentrated in one location but distributed in two or more, which might be attractive to lenders. The final effect of this variable on credit will depend on what type of effect is stronger.

The land quality index is included in Equation 2-12 so as to capture the effect of the agricultural potential of the land on household income.[23] This index varies by parish (smallest political division of the territory). In addition, given the presence of plant diseases, pests, and the predominance of traditional methods of production, those households with access to technical assistance are expected to do better in household income.

The percentage of farm labor that is hired for a wage is also expected to be positively related to household income since, as noticed in our 'statistical analysis' section, large portions of hired labor are usually a sign that the farmer is of the capitalist type, who hire labor up to the point where marginal productivity equals farm wage.

Also in Equation 2-12, having a source of off-farm income should contribute positively to household income. For Equation 2-13, the amounts of off-farm and non-labor income (which includes remittances) are incorporated as they often compensate for the lack of collateral for credit provided by NGOs, cooperatives and associations. In those cases, households who can show a steady income flow are likely to obtain more credit. Finally, household head's age,

[23] Because the LSMS survey did not include questions on land quality, our index was formed based on information at the district level provided by the Geographic and Agricultural Information System (SIGAGRO) Office of the Ministry of Agriculture of Ecuador.

education and sex are usually important variables determining credit market participation and household income.

**Estimation results:** The credit analysis for both regions indicates that farm size matters not only for accessing credit but also for the amount of credit obtained (Table 2-10). In addition, in the Sierra, other variables have a significant and larger effect than farm size on the probability of obtaining credit. Location of the household in a non-urban area reduces that probability while younger and more educated household heads are more likely to get credit.

Also, having more than one parcel increases both the likelihood of accessing credit and the amount of credit received. This result seems to indicate that the second possible effect (discussed earlier in this section) on credit access of having more than one farm is stronger than the first. Hence, operating more than one parcel appears to work as a signal of risk diversification, that is, it could indicate less risk of loosing all production if nature is unfavorable. In addition, compared to the province of Cañar, households in the provinces of Chimborazo, Cotopaxi, Imbabura and Pichincha are less likely to obtain credit.

In the Coast, the value of farm animals held by the household exerts a slightly negative effect on the probability of obtaining credit. However, since 95% of those asking for credit actually obtained it, this result suggests that households holding enough farm animals seem to be less likely to pursue a loan than households with few or no animals. Thinking of farm animals as a form of savings, rural households in the Coast would prefer to sell animals in order to meet their financial needs before asking for credit. Also, households in the province of Esmeraldas have less probabilities of acquiring credit than those in Los Rios.

The effect of farm size on the amount of credit obtained by the household is such that one more unit of land would increase credit by $18.30 in the Sierra and $24.60 on the Coast. The

dollar amount of credit obtained both in the Sierra and the Coast is significantly larger if it is obtained from formal sources and more so if the borrower was a farm owner with a land title. This suggests that the effect of land on credit is a direct rather than an indirect effect -as was hypothesized earlier.

In the Coast, the level of valued assets contributes to accessing slightly larger amounts of credit and being located in an area of concentrated agricultural production considerably increases that amount. Younger and more educated household heads receive more credit in the Sierra, and this is true also for households with larger off-farm incomes (although this effect is small). In the Sierra, households in Cotopaxi, Loja and Tungurahua receive less amounts of credit than Cañar, while in the Coast it is again households in Esmeraldas who receive less credit than Los Rios.

Results from the second stage of the estimation procedure (household income per capita), reported in Table 2-11, suggest again that farm size is positive and statistically significant. One more hectare of land per household member would increase household income per capita by $22 on average in the Sierra, which represents close to 5% of the mean household income per capita in this region. The contribution to household income per capita of one more unit of land per household member on the Coast is $43, that is, 9% of the Coast's mean household income per capita. Mean household size in each region is close to five people. Taking this into consideration, an additional hectare of land would increase total household income by $110 in average in the Sierra and $215 in average in the Coast. In addition, as expected, households that received more credit per capita generate higher per capita income in both regions.

In the Sierra, location of a household in a rural area means it makes on average $406 less per capita income than if it were located in a city. As expected, the largest negative effect on income for this category and the most significant is for households located in dispersed rural

areas. Education of the household head is again positive and of importance, this time for both regions. The effect of the number of adults per capita (interpreted as the inverse of the dependency ratio) is positive and highly significant for both Coast and Sierra and, as expected, so is the percentage of hired labor and the fact of having an off-farm source of income.

In addition, technical assistance increases household income per capita in the Sierra but it is less significant in the Coast, perhaps due to the small number of households who reported receiving this service. Finally, the regression results did not conform to our expectation that pure tenant households would make less total household income per capita than landowners. Although the sign of the effect is as expected, the significance is not.

## Conclusions

This chapter has shown that land inequality and related market imperfections have a statistically significant effect on rural household incomes. Farm size increases the probability of credit access and the amount of credit to be obtained, which also increases household income. The total effect of farm size on household income is composed by a direct and an indirect effect, through its influence on credit and labor allocation. The effect of labor market imperfections is gathered by a positive and highly significant effect of the percentage of hired labor on household income per capita. As explained in our 'statistical analysis' and 'the model' sections, land inequality together with imperfections in the labor and credit markets (i.e., a labor supply that exceeds the demand, and credit rationing) is what causes traditional family farms, who hire very little labor, to have lower labor productivity and hence lower household income per capita.

On the effect of imperfections in the land market, our section on the land rental market showed how these imperfections cause the rental market to be primarily chosen by the land poor. Also, results from our 'household income per capita estimation' section showed that landowners with title can obtain more credit than landowners without title and pure tenants. Therefore, if the

land rental market were liberalized and property rights better protected, together with reforms in the credit market, the poor are among the ones that would benefit the most as they would be able to experience increased land access.

We see then that land inequality, through its effect on related market imperfections, is an important contributor to rural poverty. However, since unequal land access and imperfections in the credit and labor markets form a synergy (because limited access to capital and low labor productivity also contribute to poverty, hence limiting the probability and size of land purchases), increased access to land needs to be accompanied by other related market reforms.

Table 2-1. Number of farms by farm size, Coast and Sierra regions, Ecuador

| Farm size | Farm operators (owner-operator and/or tenant) obs. | % | cum.% |
|---|---|---|---|
| Minifundio (less than 1 ha.) | 775 | 40.8 | 40.8 |
| Small (1 to less than 5 ha.) | 691 | 36.4 | 77.2 |
| Medium (5 to less than 40 ha.) | 358 | 18.9 | 96.1 |
| Large (40 ha. and over) | 74 | 3.9 | 100.0 |
| Total | 1,898 | 100.0 | |

Table 2-2. Credit access, type of credit and operational farm size

| | Received credit | | | | Formal* | | | Informal** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Operational area | Yes | No | Total | p† | p | $ | r% | p | $ | r% |
| Minifundio | 124 | 666 | 790 | 15.7% | 5.8% | 686 | 66.31 | 9.7% | 515 | 102.36 |
| Small | 117 | 579 | 696 | 16.8% | 4.9% | 1187 | 64.00 | 11.9% | 329 | 107.20 |
| Medium | 76 | 287 | 363 | 20.9% | 8.8% | 1880 | 68.70 | 11.6% | 1115 | 115.15 |
| Large | 7 | 70 | 77 | 9.1% | 3.9% | 8063 | 60.22 | 5.2% | 6052 | 56.88 |
| Total operators | 324 | 1602 | 1926 | 16.8% | 6.0% | | | 10.7% | | |

† Proportion of households in each category who received credit. * Formal sources of credit: governmental institutions, private banks, cooperatives, associations and non-governmental organizations (NGOs).
** Informal sources of credit: input suppliers, exporters, packers, individual lenders and relatives or friends.

Table 2-3. Mean loan terms by credit sector (all farm sizes)

| Source of credit | Number of HH | Mean $ | Mean annual r% | Mean monthly r% | Mean term (months) | %Requiring real estate as collateral |
|---|---|---|---|---|---|---|
| Formal | 127 | 1,256 | 66.12 | 4.32 | 17 | 20.5% |
| Informal | 216 | 651 | 106.21 | 6.22 | 6 | 4.2% |

Table 2-4. Agricultural labor productivity and operational farm size

| Operational farm size | Number obs.* | Average value product ($) | Non-remunerated labor days** | Hired labor | Total labor | Mean labor productivity |
|---|---|---|---|---|---|---|
| minifundio | 747 | 417 | 1,326 | 10 | 1,337 | 1.99 |
| Small | 678 | 1048 | 1,905 | 31 | 1,936 | 2.55 |
| Medium | 348 | 3417 | 2,099 | 145 | 2,243 | 3.41 |
| Large | 73 | 4141 | 2,027 | 317 | 2,345 | 6.80 |
| Total | 1,846 | | | | | |

*Only farm households who had a positive value product (from crops and animal husbandry) are included. **Includes both household and non-household members working for no wage. In the case of non-household members, this is a common practice in rural communities where farmers exchange labor, hence avoiding hiring wage labor.

Table 2-5. Household heads' primary activity and household's main source of income by operational area

| | Minifundio | | Small | | Medium | | Large | |
|---|---|---|---|---|---|---|---|---|
| | Head's main activity | HH main source of income | Head's main activity | HH main source of income | Head's main activity | HH main source of income | Head's main activity | HH main source of income |
| AGRICULTURE | % | % | % | % | % | % | % | % |
| Ag. self employed | 29 | 11 | 52 | 30 | 70 | 52 | 73 | 52 |
| Ag. worker | 24 | 25 | 21 | 27 | 9 | 15 | 8 | 11 |
| Subtotal | 53 | 35 | 73 | 57 | 79 | 67 | 81 | 63 |
| NON-AG SECTOR | | | | | | | | |
| Non-ag. self employed | 19 | | 10 | | 10 | | 10 | |
| Non-ag. worker | 25 | | 14 | | 8 | | 1 | |
| Subtotal | 44 | 53 | 24 | 35 | 18 | 27 | 12 | 32 |
| OTHER | | | | | | | | |
| Not economically active or unemployed | 3 | | 3 | | 3 | | 5 | |
| Income from rents and financial assets | | 2 | | 2 | | 1 | | 0 |
| Remittances & transfers | | 9 | | 7 | | 5 | | 5 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Table 2-6. Mean land productivity by category of farm size

| Operational area | Number obs.* | Mean land productivity | t statistic |
|---|---|---|---|
| Minifundio | 747 | 8,351.57 | -- |
| Small | 678 | 506.08 | 2.45 |
| Medium | 348 | 270.41 | 2.92 |
| Large | 73 | 64.04 | 1.96 |
| Total | 1,846 | | |

*Only farm households with a positive value product are included.

Table 2-7. Farm size distribution of land tenants

| | Tenants only | | Owner-tenants | | Total | |
|---|---|---|---|---|---|---|
| Farm size | Obs. | % | Obs. | % | Obs. | % |
| Minifundio | 98 | 49 | 86 | 29 | 184 | 37 |
| Small | 85 | 42 | 151 | 51 | 236 | 47 |
| Medium | 19 | 9 | 52 | 18 | 71 | 14 |
| Large | 0 | 0 | 6 | 2 | 6 | 1 |
| Total | 202 | 100 | 295 | 100 | 497 | 100 |
| % of total farmers | | 11 | | 16 | | 26 |

Table 2-8. Variable definition for household income per capita and credit equations

| Variable | Description |
|---|---|
| | Household income per capita equation |
| *HIPC* | Total household income per capita in US Dollars |
| *County* | Dummy variable for each county in each region |
| *Periphery* | Dummy for location of the household in the periphery of a city (base: urban area) |
| *Settlement* | Dummy for location of the household in a rural settlement (base: urban area) |
| *Disperse* | Dummy for location of the household in a dispersed rural area (base: urban area) |
| *LandQual* | Index of agricultural potential of the land (includes slope, soil texture and depth, ease of mechanization and irrigation) |
| *Male* | Dummy for sex of the household head (base: female) |
| *Age* | Age of the household head (ordinal variable) |
| *Edu* | Years of schooling of the household head (ordinal variable) |
| *AdultsPC* | Number of individuals fourteen year old or older in the household |
| *SizePC* | Farm size per capita (in hectares) |
| *Tenant* | Dummy variable, 1 if the household is a tenant in all its land holdings (base: owner) |
| *CreditHatPC* | Tobit model prediction of credit dollar amount |
| *TechAssist* | Dummy variable, 1 if the household received technical assistance |
| *%HiredLabor* | Percentage of hired labor (based on total farm labor) |
| *OffIncome* | Dummy variable, 1 if household has any source of off-farm income |
| *Rmt* | Dummy variable, 1 if the household has received any remittances |
| | Credit equation |
| *Credit* | Total dollar amount of credit received by the household (includes both formal and informal credit but only cases with positive interest rates) |
| *Province* | Dummy variable for each province in each region |
| *NonUrban* | Dummy variable for location of the household in a non-urban area |
| *AgCon* | Area of agricultural concentration (dummy variable, 1 if the household is located in a county in which over 50% of the land is in production) |
| *XCrops* | Area of concentration of export crop production (dummy variable, 1 if the household is located in area of major production of major export crops: bananas, cacao, coffee and flowers) |
| *NPlots* | Number of plots owned or operated by the household |
| *Owner* | Dummy, 1 if the household is owner of any portion of its land holdings |
| *Formal* | Dummy variable, 1 if the loan received is from formal sources |
| *%Title* | Percentage of landholdings with title |
| *Formal*Title* | Interaction term, *Formal* times *%Title* |
| *Assets* | Dollar value of assets (machinery, equipment, small productive instruments) |
| *Animals* | Dollar value of farm animals |
| *OffFarmInc* | Dollar amount of off-farm income made by the household |
| *NonLaborInc* | Dollar amount of non-labor income received by the household (includes remittances and monetary transfers) |

Table 2-9. Summary of explanatory variables (income and credit regressions)

| | Variable | Obs. | Mean or frequency | Sierra | Coast |
|---|---|---|---|---|---|
| Dep. Variable | Household income per capita ($) | 1876 | 486.03 | 487.55 | 482.03 |
| Location | Sierra | 1360 | 72.5% | | |
| | Coast | 516 | 27.5% | | |
| | Urban | 179 | 9.5% | 9% | 11.8% |
| | Non-urban: | 1697 | 90.5% | 91% | 88.2% |
| | Periphery | 81 | 4.3% | 6% | 0.0% |
| | Rural settlement | 202 | 10.8% | 10.9% | 10.1% |
| | Disperse rural area | 1414 | 75.4% | 74.1% | 78.1% |
| | Agricultural concentration | 702 | 37.4% | 23.5% | 74.1% |
| | Export crops | 458 | 24.4% | 12.7% | 55.2% |
| HH | Adults (14 and older) | 1876 | 3.11 | 3.02 | 3.35 |
| HH head | Male | 1584 | 84.4% | 81.6% | 92.0% |
| | Female | 292 | 15.6% | 18.4% | 8.0% |
| | Age: 17 to 25 years old | 100 | 5.3% | 5.3% | 5.1% |
| | Age: 26 to 45 | 722 | 38.5% | 36.8% | 42.5% |
| | Age: 46 to 65 | 723 | 38.5% | 39.0% | 37.7% |
| | Age: over 65 | 331 | 17.6% | 18.9% | 14.7% |
| | Education: zero years | 362 | 19.3% | 20.8% | 14.9% |
| | Education: 1 to 6 | 1305 | 69.6% | 68.3% | 71.8% |
| | Education: 7 to 12 | 154 | 8.2% | 7.6% | 10.1% |
| | Education: 13 and over | 55 | 2.9% | 3.2% | 3.2% |
| Farm | Size (hectares) | 1876 | 4.90 | 3.89 | 7.57 |
| | Number of plots | 1876 | 1.59 | 2.0 | 1.22 |
| | Owner | 1674 | 89.2% | 91.0% | 84.7% |
| | Tenant | 202 | 10.8% | 9.0% | 15.3% |
| | Land title | 1087 | 57.9% | 64.1% | 41.7% |
| Credit | Received formal credit | 111 | 5.9% | 7.3% | 2.3% |
| | Received informal credit | 199 | 10.6% | 10.9% | 9.7% |
| | Total credit amount ($) | 310 | 803.61 | 790.42 | 855.34 |
| Farm wealth | Value assets ($) | 1830 | 299.8 | 227.57 | 486.76 |
| | Livestock ($) | 1724 | 335.69 | 351.42 | 292.04 |
| Other variables | Technical assistance | 35 | 1.9% | 1.6% | 2.5% |
| | Hired labor | 632 | 33.7% | 30.1% | 43.2% |
| | Off-farm income ($) | 1421 | 1,923.57 | 1,991.07 | 1,759.39 |
| | Non-labor income ($) | 1090 | 244.01 | 257.85 | 210.41 |
| | Remittances | 287 | 15.3% | 16.0% | 13.3% |

Table 2-10. Credit regressions for the probability of obtaining credit and the amount of credit

| Explanatory variables | Credit Sierra Probit | | $ Credit Sierra Censored Tobit | | Credit Coast Probit | | $Credit Coast Censored Tobit | |
|---|---|---|---|---|---|---|---|---|
| *Azuay* | 0.082 | | 197.253 | | | | | |
| *Bolivar* | -0.150 | | -206.300 | | | | | |
| *Carchi* | -0.289 | | -61.254 | | | | | |
| *Chimborazo* | -0.626 | ** | -813.950 | | | | | |
| *Cotopaxi* | -0.900 | ** | -480.558 | *** | | | | |
| *Imbabura* | -0.496 | * | -831.628 | | | | | |
| *Loja* | -0.248 | | -142.438 | *** | | | | |
| *Pichincha* | -0.489 | * | -410.020 | | | | | |
| *Tungurahua* | -0.271 | | -362.834 | * | | | | |
| *El Oro* | | | | | -0.126 | | 89.716 | |
| *Esmeraldas* | | | | | -0.838 | * | -489.137 | * |
| *Guayas* | | | | | 0.199 | | 189.723 | |
| *Manabí* | | | | | -0.245 | | -156.020 | |
| *NonUrban* | -0.343 | * | 104.663 | | -0.049 | | -109.625 | |
| *Agcon* | 0.042 | | 270.825 | | 0.278 | | 457.649 | ** |
| *Xcrops* | 0.153 | | -158.539 | | -0.206 | | -98.238 | |
| *Male* | 0.192 | | 56.079 | | -0.045 | | 6.025 | |
| *Age* | -0.200 | *** | -165.633 | *** | 0.056 | | -21.790 | |
| *Edu* | 0.302 | *** | 238.852 | *** | 0.077 | | -83.297 | |
| *Size* | 0.026 | * | 20.772 | * | 0.062 | ** | 34.104 | ** |
| *Size*$^2$ | -0.0004 | | -0.322 | | -0.001 | * | -0.640 | * |
| *NPlots* | 0.186 | *** | 150.108 | *** | 0.158 | | -76.575 | |
| *Owner* | -0.176 | | -165.450 | | -0.089 | | 100.187 | |
| *%Titled* | -0.002 | | 105.718 | | -0.220 | | -13.122 | |
| *Formal* | | | 1473.730 | *** | | | 1092.042 | *** |
| *Formal*Title* | | | 602.740 | *** | | | 813.476 | ** |
| *Assets* | -0.00001 | | 0.018 | | 0.00003 | | 0.033 | ** |
| *Animals* | 0.00003 | | -0.060 | | -0.00038 | * | -0.264 | |
| *OffFarmInc ($)* | 0.00004 | | 0.056 | *** | 0.00001 | | 0.021 | |
| *NonLaborInc ($)* | | | 0.017 | | | | -0.009 | |
| *Rmt* | -0.157 | | | | 0.014 | | | |
| *Constant* | -0.781 | ** | -1200.427 | *** | -1.772 | ** | -786.920 | |
| R2 | | | 0.34 | | | | 0.66 | |

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

Table 2-11. Household income per capita regression

| Explanatory variables† | Per capita HH Income Sierra OLS (robust standard errors) | | Per capita HH Income Coast OLS (robust standard errors) | |
|---|---|---|---|---|
| | Coefficient | P>\|t\| | Coefficient | P>\|t\| |
| *Periphery* | -408.379 | 0.019** | --- | --- |
| *Settlement* | -332.328 | 0.072* | -95.994 | 0.602 |
| *Disperse* | -476.745 | 0.005*** | -219.228 | 0.253 |
| *LandQual* | -29.729 | 0.420 | 89.438 | 0.263 |
| *Male* | 1.044 | 0.978 | 55.588 | 0.321 |
| *Age* | -19.732 | 0.343 | -38.875 | 0.119 |
| *Edu* | 159.395 | 0.019** | 74.376 | 0.050* |
| *SizePC* | 25.122 | 0.019** | 69.902 | 0.001*** |
| $SizePC^2$ | -0.391 | 0.092* | -1.773 | 0.007*** |
| *AdultsPC* | 504.534 | 0.000*** | 400.848 | 0.000*** |
| *Tenant* | -67.702 | 0.203 | -62.124 | 0.168 |
| *%Hired labor* | 601.851 | 0.000*** | 383.302 | 0.002*** |
| *CreditHatPC* | 0.531 | 0.030** | 0.829 | 0.092* |
| *TechAssist* | 237.380 | 0.099* | 241.940 | 0.140 |
| *OffIncome* | 231.235 | 0.000*** | 346.803 | 0.000*** |
| *Rmt* | -23.526 | 0.583 | -43.865 | 0.304 |
| *Constant* | -565.125 | 0.002*** | -355.581 | 0.271 |
| Degrees of freedom | 1288 | | 467 | |
| R2 | 0.30 | | 0.61 | |

† Also included in the regressions were 22 counties for the Sierra (16 were significant at 10% significance) and 20 for the Coast (only 3 significant). *** Significant at 1%; ** significant at 5%; * significant at 10%

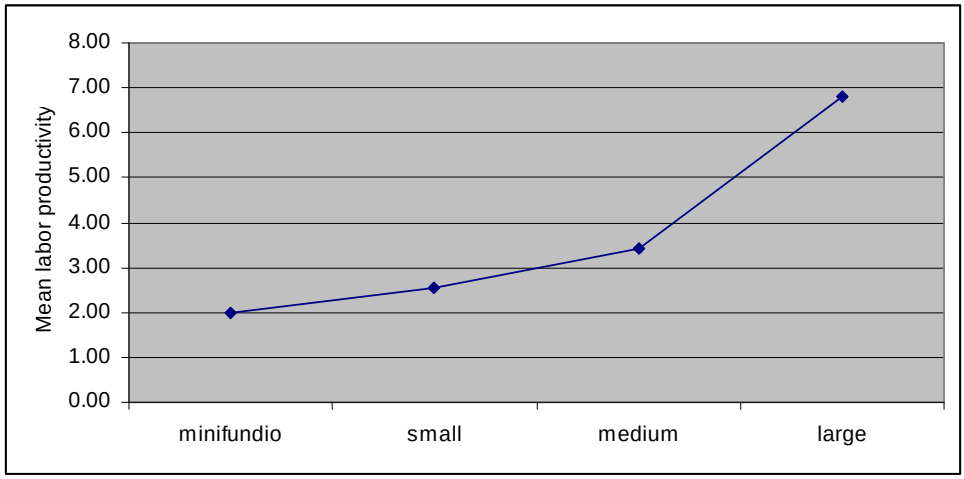



Figure 2-1. Mean labor productivity by farm size

# CHAPTER 3
# UNDERSTANDING LAND RESERVATION VALUES IN THE PRESENCE OF MULTIPLE MARKET IMPERFECTIONS: THE ECUADORIAN CASE

## Introduction

The presence of multiple market imperfections causes land reservation prices[1] to differ from the present value of a stream of residual returns to land. Rural areas in Ecuador are characterized by land inequality, segmented land markets, incomplete credit markets, high transaction costs inhibiting land titling, and dualistic structures in the labor market (Chapter 2). All these market imperfections can have an effect on land prices causing these values to diverge from the productive ability of the land.

Schultz (1945) explains how agriculture is an activity with a high share of fixed costs compared to other sectors of the economy. Such additional fixed costs represent factors of production whose supply and demand are hard to adjust to macroeconomic conditions (quasi-fixed factors). Market imperfections such as those mentioned above further limit the marketability of factors of production, hence worsening the quasi-fixity of factors. As a result, the Classical (Ricardian) notion of residual rents -which regards land as the only fixed factor in agriculture- would misstate returns to land and therefore would fail to fairly represent land values (Mishra et al., 2004).

In addition, imperfections in the credit market create capital constrained households to have larger shadow capital rates (or discount rates) than unconstrained households, hence reducing the present value of land for the former (Carter and Salgado, 2001).

In spite of its importance for land inequality and rural development, the study of the formation of land values is not common in Latin America. This is partly due to the unreliability

[1] Reservation prices are defined as the minimum payment a landowner would accept in exchange for his/her land.

of land price information in the local land registries -when this information is even collected. Thanks to the Living Standard Measurement Surveys, however, information about land reservation prices in Ecuador is available. This data allows us to empirically analyze the configuration of individuals/households' land prices by examining the variables that affect an individual's valuation of land.

The purpose of this chapter is to understand the factors that come into play when individuals are asked to value their farmland. We would like to find out how closely land values represent land quality and productivity, as opposed to inefficiencies in land and related markets (credit, labor) or other non-productive factors (such as holding land for status). Similar to Carter and Zegarra (1995), we recognize that we are dealing with a hypothetical question and so answers need to be interpreted carefully. However, these answers offer a "first window in the economics of land market competitiveness" in Ecuador (Carter and Zegarra, 1995: 15).

Land market prices are the result of buyer and seller interaction, the first having some –at least implicit- limit price and the second a reservation price (Currie, 1981). In this chapter we study only the formation of reservation prices; however, this should shed light not only on how market prices are likely formed, but also on who is more likely to end up selling their land.

## Data and Methodology

In the Classical tradition, returns to land are commonly measured as residual returns, that is, after discounting variable production costs from farm income. However, in order for this approach to fairly reflect land values, we would need to assume that all other factors of production have the same value for all farmers, that is, that their values are equal to market prices (Mishra et al., 2004).

In the context of developing countries, such as Ecuador, this assumption is not plausible since land is not the only quasi-fixed factor in farm production. The presence of imperfections in

the credit, land and labor markets (Chapter 2) results in family labor being trapped on the family farm and similarly, for intermediate farm assets[2] and farm animals,[3] especially for low-wealth rural households. As a consequence, market imperfections produce shadow factor values to differ from market prices and they dictate the efficiency of factor allocation. These prices then affect agricultural profits and land values. Thus, the Classical measure of residual returns misstates land prices if labor and other factors are discounted at market prices instead of farmers' shadow values (Mishra et al., 2004).

An approach that would take all those factors into consideration is one based on a dual profit function with a flexible functional form. We use data from the Living Standard Measurement Survey carried out in Ecuador between October 1998 and September 1999, which gathers household data on farm income, for households who harvested at least one crop and provided land reservation price responses.

**Restricted Profits**

In our case, a restricted quadratic profit function fulfills our objective as it fits our data well. The restricted profit function specification (Equation 3-1), which takes into account quasi-fixed factors, is as follows:

$$\begin{aligned}\Pi = {} & \beta_0 + \sum_{i=1}^{n} \beta_i X_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{h=1}^{n} \gamma_{ih} X_i X_h + \sum_{k=1}^{m} \alpha_k Z_k + \frac{1}{2}\sum_{i=1}^{n}\sum_{k=1}^{m} \delta_{ik} X_i Z_k + \\ & \frac{1}{2}\sum_{k=1}^{m}\sum_{j=1}^{m} \varphi_{kj} Z_k Z_j + \theta_i Province + \theta_i Quality * A + \theta_i NP * A + \theta_i \%Owned * A + \\ & \theta_i \%Title * K + \theta_i Age + e \end{aligned} \tag{3-1}$$

[2] For small family farms especially, the acquired farm equipment is mostly the basic necessary for production, such as tools and simple fumigation equipment, which have little value outside the family farm.

[3] For poor households, farm animals are a common form of savings for times of need.

The symbol $\Pi$ represents returns to fixed (or quasi-fixed) factors $Z_k$, where $k$ = operational land holdings, family labor days, intermediate assets, and farm animals (Table 3-1 for average and median measures). More specifically, $\Pi$ is total value of crop production minus variable costs including the cost of hired labor. $X$ is a vector of output (temporary and perennial crops)[4] and hired labor prices. It is assumed that the price of inputs such as fertilizer, pesticides and seeds are the same for all farmers in a province, hence there would be no significant variability in these prices and their effect can be assumed to be captured by the province dummies (*Province*).[5]

Intermediate assets represent household reservation prices of farm equipment which includes mainly farm tools, fumigation pumps and animal plowing equipment. Also included are water pumps and trucks (reported by less than 5% of the households in the data set) and animal sheds, irrigation equipment, electric plants, tractors and sowing machines (reported by less than 1% of the cases). Farm animals include cattle, horses, pigs, poultry, among other farm animals held by the household at the time of the survey, valued at the average selling price reported in the data set (by households who sold animals) for each type of animal.

Additional variables in the specification which affect the contribution of land to profit (land interaction effects) are land quality[6] (*Quality*); the number of plots (*NP*); and the percentage of land owned of the total land operated (*%Owned* = size owned/size operated).

Based on the concept of scale economies, for a household with more than one plot of land, returns to land should in general be smaller than those for a household whose holdings are

[4] The output prices consist of two Fisher's price indices, one representing temporary crop prices and the other one summarizing perennial crop prices. See Castillo et al. (2007) about the methodology used in the replacement of missing price observations for the formation of these price indices.

[5] It would be superior to include district-level prices in the profit function; however such data is not available in our data set (it was not collected in the LSMS survey).

[6] Land quality is measured by an index which takes into account slope, soil texture, depth and ease of mechanization and irrigation.

contiguous. However, it is important to consider an Andean production strategy still practiced in the Ecuadorian highlands which date from the time of the Incas. The optimizing strategy consists of the exploitation of small, dispersed plots of land at different elevations with the purpose of taking advantage of the different ecological levels offered by the geography of the Andes (Alvarez, 1995). This strategy also spreads risks due to weather and disease.

Our data show that the mean number of land parcels in the Sierra is 1.9, while only 1.3 on the Coast (the median is 2 parcels in the Sierra and 1 on the Coast). Also, 77% of the households with less than 5 hectares (in total operational holdings) are located in the Sierra. Since 72% of the households in our sample are from this region, the beneficial effect of the Andean strategy could prevail in our results, hence making the returns to land larger, the greater the number of land parcels held by the household.

It would generally be expected that the effect of the share of land farmed which is owned would be positive on the returns to land, based on the hypothesis that owner-operators make better investment decisions than tenants,[7] especially since over 70% of the owner-tenants in our sample had shared-tenancy arrangements.[8] Nevertheless, under pure land ownership, production and price risk are totally internalized by the farmer and, in cases of poverty and restricted access to credit, the risk bearing capacity of the farmer is usually lower than required in order to reach efficiency in factor allocation.

In addition, our data show that 99.5% of owner-tenant households fully exploited their owned holdings. Also, Table 3-2 shows that 49% of owner-tenant households owned less than 1

[7] 20% of the landowner households in the sample were owner-tenants. Among these, there are two types of tenancy arrangements: fixed-rent (cash payment) and shared-rent or sharecropping (with in-kind payments, a mixture of cash and in-kind payments or payments with labor).

[8] Classical and Neo-Classical economists widely considered sharecropping as an inefficient form of tenure because it would create a disincentive for the tenant: He/she would only use a factor up to the point where only his/her share of the marginal value product –as opposed to the total marginal value product- equals the factor's price.

hectare and 88% owned less than 5 hectares. In light of this, households with smaller shares of owned land relative to their operational holdings appear to be small farm owners who need to acquire additional land. This effect can thus speak to the competitiveness of this kind of farm household compared to those who only operate their own property.

A related hypothesis is that households with title to their lands, compared to those who do not have title, are more likely to make fixed investments in the land, hence generating greater profits. Moreover, titled land can facilitate access to formal credit, further increasing profits. Thus, the variable %*Title* is included interacting with the value of assets (*K*). In other words, it is expected that the effect of intermediate assets on the returns to quasi-fixed factors ($\Pi$) would vary depending on whether the household has a land title (or a larger share of titled land).

The evidence about the effect of land titling in the developing world is, however, mixed. In Thailand Feder et al. (1988) show that land titles improve tenure security, increase investment and enhance land values. On the other hand, studies in some parts of Sub-Saharan Africa (Migot-Adholla et al., 1993) and Latin America (see Gould, 2001 on Guatemala and Carter and Salgado 2001 on Paraguay, Honduras and Chile) have found very little and at times ambiguous total effects of land titling programs on farm productivity, the dynamization of land markets, credit access and land values. We shall then observe the direction of this effect in the case of Ecuador.

Also included in the restricted profit equation is the age of the household head (*Age*) so as to capture the likely negative effect of less efficient farm labor and/or management of older farmers (Carter and Salgado, 2001).

We estimate the profit function and then test for monotonicity and convexity in prices, properties of the profit function. If the function is not convex, we perform a bootstrap procedure, by which a new sample is randomly created each time based on our data set and new estimates

computed. This is done 1,000 times, providing 1,000 coefficient estimates out of which we retain those that are convex in prices. Our final estimates are the average of the convex coefficients (Terrell, 1996; Moss et al., 2008).

An appropriate measure of returns to land, which includes farmers' heterogeneity in endowments, is obtained by taking the derivative of the profit function with respect to land (A), as follows:

$$\frac{\partial \Pi}{\partial A} = \alpha_A + \sum_{i=1}^{n} \delta_{iA} X_i + \sum_{j=1}^{m} \varphi_{Aj} Z_j + \theta_i NP + \theta_i Quality + \theta_i \%Owned \qquad (3\text{-}2)$$

Based on the hypothesis that small farmers can be more competitive in the land market (see Carter and Salgado, 2001 about the 'peasant hyper-competitiveness' case[9]), we expect land shadow values to be positive but decreasing with the amount of land in operation. This hypothesis has its roots in the labor advantage of poor farmers (abundant labor and little or no need for supervision given their use of family labor) by which they tend to be more productive per unit of land (Carter and Zegarra, 2000; see also Chapter 2) and therefore should be willing to pay more for the land. However, we will see below how this competitiveness is expected to be undermined due to the presence of credit constraints which primarily affect small farmers. This will be reflected in the level of land reservation prices.

**Land Reservation Prices**

The reservation value of owned land for the *ith* agricultural household ($V_i$) can be expressed as Equation 3-3, where $r_i$ is the household's discount rate, $T$ is the time horizon the household expects to hold the land, and $P^e$ the expected future land selling price in period $T$+1.

[9] Under the assumption that all farmers face the same cost of capital, Carter and Salgado (2001) show that farmers with the lowest land to labor endowment ratio have the highest shadow land price

$$V_i = \left[ \sum_{t=1}^{T_i} \frac{\partial \Pi_{it} / \partial A_i}{(1+r_i)^t} \right] + \frac{P^e}{(1+r_i)^{T+1}} \tag{3-3}$$

Now, taking into account land insecurity, which arguably (as indicated earlier) can come from lack of land title, land values would be negatively affected for the case of landholders who fail to prove ownership through a formal land title. In such case, land value can be expressed as Equation 3-4, where $\phi_i$ represents the probability of the *i*th household loosing their land and where the selling price component is omitted.

$$V_i = \sum_{t=1}^{T_i} (1-\phi_i)^t \frac{\partial \Pi_{it} / \partial A_i}{(1+r_i)^t} \tag{3-4}$$

Another crucial aspect in land valuation is the discount rate particular to the household. Imperfections in the credit market cause some households to be credit constrained. These are households who either have being denied credit, do not have sufficient collateral to secure a loan, or had the opportunity to get credit but preferred not to for fear of loosing their collateral (Boucher et al., 2005; Guirkinger and Boucher, 2005).

Credit constrained households are also called non-price rationed (Boucher et al., 2005; Guirkinger and Boucher, 2005) as their ability to obtain credit is limited by reasons other than the interest rate. On the other hand, price-rationed households are those who either obtained loans or decided not to ask for credit because the interest rates were too high or due to reasons different than those of the non-price rationed households.

It follows from this analysis that non-price rationed (or credit constrained) households have a shadow price for capital larger than those who are simply price rationed, hence they will have higher discount rates and smaller land reservation prices. In addition, they are pushed to produce with less profitable capital intensities (reflected in smaller shadow land values), which further influence their ability to pay for land. As a consequence, these households tend to have

lower risk-bearing capacity and this, inter-temporal considerations aside,[10] guides them to choose safe but low-yielding activity portfolios in which land is not abundantly present (Zimmerman and Carter, 2003). In other words, capital constrained households will be more likely to sell their land than unconstrained households.

Because of the small share of landowner households in our sample who received credit at a positive interest rate (18%), we are unable to use interest rates on loans in order to approximate households' discount rates. Instead we concentrate on the reasons why households did not obtain credit, which leads us to classify them as price or non-price rationed households.[11] Like Carter and Salgado (2001), we expect credit constraints to be correlated with the risk-bearing capacity of the households.

Table 3-3 illustrates the incidence of credit constrained households in Ecuador by farm size. As the last column shows, the largest portion of rationed households is made up by *minifundistas* and this portion decreases as farm size increases. Similar to the findings of Carter and Salgado (2001) for Paraguay, and Boucher et al. (2005) for Honduras and Nicaragua, land poor households are the ones that are most likely to be constrained in the credit market. Thus, like Carter and Zegarra (2000) suggest, we expect land prices per hectare to fall very quickly from the small farmer advantage indicated in our 'restricted profits' sub-section because of credit constraints.

[10] The possibility of trading off current consumption for assets usually helps resource-poor households accumulate capital but risk and other dynamic factors undermine the benefits of this strategy (Carter and Salgado, 2001; Zimmerman and Carter, 2003).

[11] Based on the information offered by the LSMS survey we classified households as credit constrained (or non-price rationed) if they reported to have asked for credit but did not receive it, or if they did not ask for credit due to: a) did not know any lenders; b) already had debt; c) lenders asked for too many prerequisites; d) did not know how to ask for credit; e) did not have collateral wealth; f) did not have land ownership title; g) fear of losing the collateral; or h) did not have any guarantors. Price rationed households are made up by those who either obtained credit or did not ask for credit because: i) they did not need credit; j) interest rates were too high; or k) their income was not stable enough.

Given data limitations, we can only analyze one year's worth of returns to land. However, making the assumption that our year of analysis represents an average crop year in Ecuador, we can estimate a log-linear function of the following form:

$$\ln\left(\frac{V}{A^0}\right) = \beta_0 + \beta_i Coast + \beta_i NonUrban + \beta_i AgCon + \beta_i XCrops + \beta_i \ln ShadowAV + \beta_i \ln A^0 L^0 Endow + \beta_i NonPRat + \beta_i \%Titled + u \quad (3\text{-}5)$$

Where,

- $V/A^0$ = land reservation value per owned hectare
- *Coast* = dummy variable for a household located in the coastal region (base: Sierra)
- *NonUrban* = dummy variable for households located in a non-urban area (base: urban)
- *AgCon* = dummy variable for households located in areas of agricultural concentration
- *XCrops* = dummy variable for households in areas of major export crop production
- *ShadowAV* = shadow land value $= \partial\Pi / \partial A$
- $A^0L^0Endow$ = land to labor endowment ratio (owned hectares/family labor days)
- *NonPRationed* = dummy for non-price rationed households (base: price-rationed)
- *%Titled* = percentage of total owned land that is titled

The means of all variables in Equation 3-5 are shown in Table 3-4. Location effects on land values are represented by the region (*Coast*), the non-urban effect (*NonUrban*), the concentration on agriculture (*AgCon*)[12] and the major export crop production areas (*XCrops*)[13] effects. Land speculation is commonly found in areas of export crop production (Lambert and Stanfield, 1990) or in areas of agricultural concentration and so location of the farm (as approximated by location of the household) in such areas is expected to increase individuals'

[12] Based on results from the latest agrarian census in Ecuador (2000), counties in which over 50% of the land was in production are regarded here as areas of agricultural concentration. The census added fallow lands and shrimp pools as land in production and it excluded moorlands, mountains, forests and areas with infrastructure.

[13] These are the most productive counties in the production of major export crops, namely, bananas, coffee, cocoa and flowers.

land reservation prices. High inflation rates during the year of the survey, 1998-1999, (between 40 and 60%) may make these effects even stronger (Carter and Zegarra, 2000).

The percentage of titled land (*%Titled*) is included in this equation in order to observe the probable effect of land insecurity, arguably represented by lack of land title.

The land to labor endowment ratio ($A^0L^0Endow$ ) will reflect how land values per hectare vary as farm size increases relative to available labor. Just as shadow land prices are expected to decrease with the number of hectares in operation, land reservation values are expected to decrease with the land to labor endowment ratio. However, the advantage that farmers with low endowment ratios may have with respect to reservation prices is anticipated to be weakened or overcome by restrictions in the credit market (*NonPRat* dummy), where better endowed farmers are expected to surpass those who are poor. Following de Janvry et al. (2001), failures in rural markets cause landownership to provide side benefits that increase land prices[14] and many of these benefits are more likely to be enjoyed by large but not by small farm owners. Credit access is one of those benefits. On the other hand, the reservation price of better endowed households is expected to eventually fall again due to disadvantages in the labor market overcoming their capital advantage (Carter and Salgado, 2001).

## Results

The profit function estimates (Equation 3-1) in Table 3-5 reveal the effect of land and other quasi-fixed factors on restricted farm profits. Conforming to the theory, more land increases profits but with diminishing returns (see coefficient of $A^2$). Returns to land are also significantly increasing with the value of assets, and decreasing with the value of farm animals. They are also

[14] Those benefits are that land serves as a store of wealth especially in times of high inflation; it provides a source of self-employment; it serves as collateral for credit; it can have speculative value; it can offer tax breaks and it provides political and social capital (de Janvry et al., 2001).

larger the better the quality of the land, and smaller the greater the amount of land that is owned. The last result confirms our expectations that owner-tenants are more competitive than pure owners as they strive to expand their operational size. Also, the number of plots, although positive did not significantly affect the returns to land.

In total, for a median farm household, one more unit of land would increase restricted profits by $5,306.23. Figure 3-1 shows how with a few exceptions, shadow land values are decreasing in operational farm size, which conforms to what was anticipated in our 'restricted profits' sub-section.

In addition, the contribution of intermediate assets to restricted profits is also positive and decreasing. It also decreases with the number of non-remunerated labor days and with the value of farm animals. The effect of land titles turns out to be positive but not significant, which implies that titled land does not significantly improve the effect of intermediate assets on profits.

Shadow values of all factors indicate that intermediate assets and land contribute the most to agricultural restricted profits while the value of animals has a smaller contribution and non-remunerated labor contributes the least. Taking into account the size of the median household's quasi-fixed factors (Table 3-1), the shadow price results seem to reflect fairly the reality of the median farm household in Ecuador. Also, as expected, households with older heads made fewer profits than those with younger heads, indicating the lower efficiency of labor and/or management caused by age.

Results from Equation 3-5 show that shadow land values contribute positively and significantly to land reservation prices (Table 3-6). As expected, better endowed households have lower reservation prices per hectare than households with low land to labor endowment ratios, but this advantage of poor households is undermined by their being constrained in the

credit market. More specifically, while a 1% increase in the land to labor ratio would decrease land reservation prices by 0.31%, a credit constrained household (which is more likely to be a land poor household) has a land reservation price per hectare 0.55% lower than an unconstrained household.

As anticipated, Figure 3-2 shows that land reservation prices per hectare are very high for households with low endowment ratios (less than 0.02 hectares per family labor day or less than 2 hectares in total) but they decrease rapidly especially for those who are credit constrained. As shown in Table 3-3, most credit constrained households have less than 5 hectares.

Also, while reservation prices per hectare range from $46 to over $50,000 for households with less than 5 hectares, for households with 17 hectares or more, reservation prices range from $3 to less than $2,000. This conforms to Carter and Salgado (2001)'s simulation findings that reservation prices would be larger for credit unconstrained households but smaller again as farm size continues to increase due to disadvantages in the labor market.

In areas of agricultural and export crop concentration, land reservation values are significantly higher than in other areas, which as indicated earlier can be indicative of the land speculation usually found in these zones. However, land reservation values are smaller as we move away from the urban centers and this effect is stronger than the effect of agricultural concentration and export crop areas combined. This suggests that the value of land close to urban areas is highly influenced by the advantage of being closer to major markets. Also probably included in this effect is the possibility of rural land conversion to semi-urban settlements (Lambert and Stanfield, 1990). In addition, households in the coastal region have smaller reservation prices per hectare than those in the highlands (Sierra), presumably because there is more competition for land in the Sierra given that land is less abundant.

Finally, with respect to the percentage of titled land, this effect is again not significant (see results from the profit function), which reveals that although almost 30% of the land in the sample was not titled, this does not seem to be causing serious problems of land insecurity. One alternative explanation for this result is that in many cases land titles are likely to be only certificates of possession or similar documents which have not been properly registered (see Chapter 2 about the high transaction costs discouraging title registration). Hence, the existence of a title-like document is not capturing information on security of land rights, causing higher shares of titled land not to make a difference on either investment or land values. Another possible explanation is that, like the findings of Carter and Salgado (2001), land titles do not contribute to easing small farmers' credit constraints; therefore, even if providing security of land rights, in the case of small farmers (which make up the majority in our data set) land titles cannot be used to improve credit access in order to increase investment, then the effect of land titles on investment and land values turns insignificant.

## Conclusions

This chapter has shown that the presence of multiple market imperfections intensifies the quasi-fixity of factors other than land, which affects the contribution of land to profits (shadow land values) and consequently, land values. Also, incomplete credit markets leave some households unattended, affecting their shadow capital values and risk bearing capacity, which is reflected in higher discount rates and smaller land reservation prices. These households are therefore more likely to sell their land in moments of financial distress.

We have also found graphically that the difference in reservation prices per hectare between small and medium and large farmers is remarkable. This can be explained by the labor advantage of small farmers, which makes them more productive per unit of land than larger farmers. This effect, however, is reduced by the credit constraints mostly experienced by small

farmers. Yet, for farms of 17 hectares or more, reservation prices turn smaller again as farm size continues to increase, reflecting the disadvantage of large farmers in the labor market.

In addition, although land values are higher in areas of concentration of agricultural production and/or export crop production, the relative marginalization of non-urban areas severely affects land values. This is likely due to the distance of non-urban farm households from urban markets, a disadvantage that is exacerbated by the need for more and better road access in rural Ecuador. Another reason is the possibility of rural land conversion in lands close to the cities, which increases land values for these landowners.

Finally, in this Ecuadorian case, lack of land titles did not effectively discourage investments in land and did not cause land values to be smaller than for households with titled land (or having a larger share of titled land). This was likely due to the possibility that land titles are not registered, hence not providing the full benefits of a title, or due to the pervasiveness of credit constraints which limit the potential benefits of land titles as a device that would facilitate access to credit by allowing small landowners to pledge the land as collateral.

Table 3-1. Mean and median quasi-fixed factors

| Quasi-fixed factors | Mean | Median |
|---|---|---|
| Operational land holdings (ha.) | 7.95 | 2.00 |
| Non-remunerated labor (days) | 1,911.94 | 1,152.00 |
| Intermediate assets ($) | 419.75 | 42.30 |
| Farm animals ($) | 415.44 | 222.97 |

Table 3-2. Classification of owner-tenant households by category of owned farm size

| Owned farm size | Owner-tenants | Proportion (%) | Cumulative (%) |
|---|---|---|---|
| Minifundio (less than 1 ha.) | 79 | 49.1 | 49.1 |
| Small (1 to less than 5 ha.) | 62 | 38.5 | 87.6 |
| Medium (5 to less than 40 ha.) | 19 | 11.8 | 99.4 |
| Large (greater than 40 ha.) | 1 | 0.6 | 100.0 |
| Total | 161 | 100.0 | |

Table 3-3. Credit constrained households by owned farm size

| Farm size | (a) Credit constrained HH | (b) Total HH by farm size | Row % (a/b) | % of Total (a/c) |
|---|---|---|---|---|
| Minifundio | 44 | 302 | 14.57% | 5.35% |
| Small | 41 | 304 | 13.49% | 4.99% |
| Medium | 22 | 179 | 12.29% | 2.68% |
| Large | 7 | 37 | 18.92% | 0.85% |
| Total | 114 | (c) 822 | 13.87% | 13.87% |

Table 3-4. Summary of variables (land reservation value equation)

| Variable | Obs. | Mean or frequency |
|---|---|---|
| Total reservation price ($V$) | 822 | 5,088.90 |
| Size Owned ($A^0$) | 822 | 7.62 |
| Reservation price per hectare ($V/A^0$) | 822 | 83,601.44 |
| Region: Coast | 229 | 27.86% |
| Region: Sierra | 593 | 72.14% |
| Area of agricultural concentration *(AgCon)* | 370 | 45% |
| Area of export crop concentration *(XCrops)* | 233 | 28% |
| Urban area | 78 | 9% |
| Non-urban area | 744 | 91% |
| Land to labor endowment ratio ($A^0L^0Endow$) | 822 | 0.019 |
| Non-price rationed households | 114 | 14% |
| Percentage of land holdings with title *(%Titled)* | 822 | 0.703 |

Table 3-5. Returns to fixed factors equation (quadratic function)

| Explanatory Variables | Coefficient | P>\|t\| | Explanatory Variables | Coefficient | P>\|t\| | Explanatory Variables | Coefficient | P>\|t\| |
|---|---|---|---|---|---|---|---|---|
| *Azuay* | -0.042 | 0.036** | *Pt*W* | 0.169 | 0.048** | *AniW*$^2$ | -0.739 | 0.274 |
| *Bolivar* | 0.008 | 0.346 | *Pp*W* | 0.051 | 0.334 | *Quality*A* | 0.922 | 0.010** |
| *Cañar* | -0.022 | 0.197 | *W*$^2$ | 0.229 | 0.138 | *NP*A* | 1.027 | 0.226 |
| *Carchi* | -0.048 | 0.051* | *Pt*Labor* | 0.084 | 0.195 | *%Owned*A* | -2.812 | 0.000*** |
| *Chimborazo* | 0.016 | 0.217 | *Pp*Labor* | 0.206 | 0.036** | *%Titled*K* | 0.923 | 0.223 |
| *Cotopaxi* | 0.013 | 0.423 | *W*Labor* | 0.307 | 0.025** | *Age* | -0.055 | 0.028** |
| *Imbabura* | 0.053 | 0.021 ** | *Labor*$^2$ | 0.002 | 0.496 | *Constant* | 0.106 | 0.001*** |
| *Loja* | 0.053 | 0.007 *** | *Pt*K* | -1.604 | 0.116 | D. of freedom | 766 | |
| *Tungurahua* | 0.024 | 0.161 | *Pp*K* | -6.099 | 0.000*** | R-squared | 0.38 | |
| *El Oro* | -0.016 | 0.304 | *W*K* | -2.323 | 0.113 | | | |
| *Esmeraldas* | 0.040 | 0.030** | *Labor*K* | -2.823 | 0.046** | | | |
| *Guayas* | 0.006 | 0.429 | *K*$^2$ | -11.569 | 0.001*** | | | |
| *Los Rios* | 0.013 | 0.336 | *Pt*A* | 0.783 | 0.062* | | | |
| *Manabí* | -0.024 | 0.121 | *Pp*A* | -0.056 | 0.463 | | | |
| *Pt (temporary crop price index)* | 0.259 | 0.001 *** | *W*A* | -0.289 | 0.370 | | | |
| *Pp (perennial crop price index)* | -0.145 | 0.040** | *Labor*A* | -0.340 | 0.308 | | | |
| *W (hired labor wage rate)* | -0.201 | 0.015** | *K*A* | 20.092 | 0.000*** | | | |
| *Labor* | -0.032 | 0.369 | *A*$^2$ | -5.638 | 0.000*** | | | |
| *K (intermediate assets)* | 3.511 | 0.007*** | *Pt*AniW* | 1.076 | 0.015** | | | |
| *A (land)* | 3.084 | 0.000*** | *Pp*AniW* | 0.589 | 0.133 | | | |
| *AniW (farm animals)* | 0.154 | 0.358 | *W*AniW* | -0.490 | 0.284 | | | |
| *Pt*$^2$ | 0.389 | 0.005*** | *Labor*AniW* | -0.531 | 0.212 | | | |
| *Pt*Pp* | 0.099 | 0.120 | *K*AniW* | -12.853 | 0.003*** | | | |
| *Pp*$^2$ | 0.509 | 0.003*** | *A*AniW* | -3.361 | 0.005*** | | | |

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

Table 3-6. Log of the land reservation price equation

| Explanatory variables | Coefficient | P>\|t\| |
|---|---|---|
| *Coast* | -1.212 | 0.000*** |
| *AgCon* | 0.508 | 0.000*** |
| *XCrops* | 0.664 | 0.000*** |
| *NonUrban* | -1.681 | 0.000*** |
| *lnShadowAV* | 0.825 | 0.006*** |
| $lnA^0/L^0$ | -0.312 | 0.000*** |
| *NonPRationed* | -0.551 | 0.001*** |
| *%Titled* | 0.141 | 0.246 |
| *Constant* | 5.491 | 0.000*** |
| Degrees of freedom | 803 | |
| R-squared | 0.37 | |

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

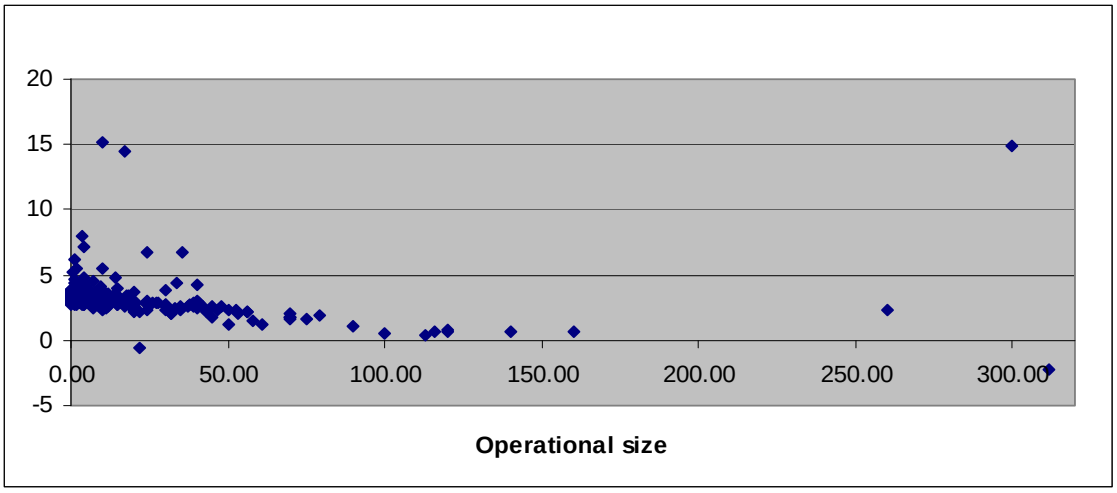
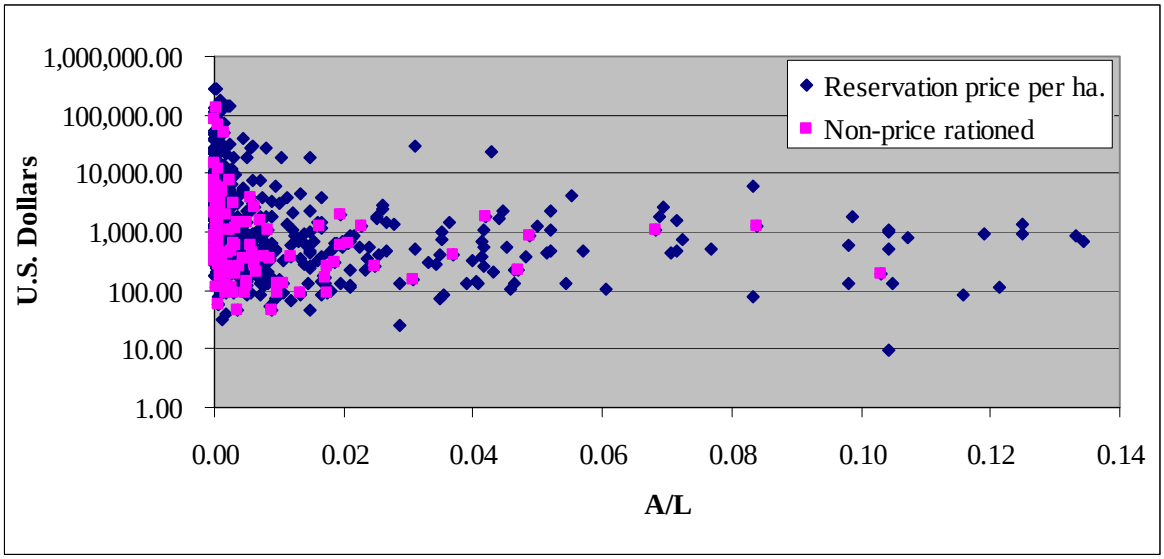
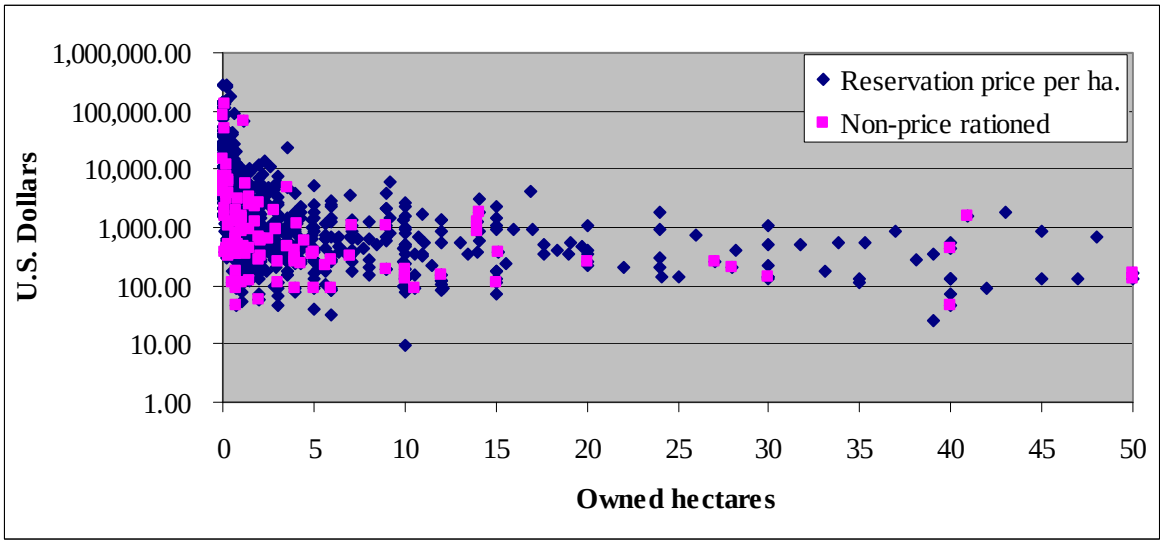



Figure 3-1. Shadow land values




A.




B.

Figure 3-2. Land reservation prices per hectare and non-price rationed households. A) Relationship with respect to the land to labor endowment ratio. B) Relationship with respect to the amount of hectares owned. Both figures show only 95% of the data and are drawn in logarithmic scale for observational purpose.

# CHAPTER 4
# RURAL LAND MARKET PARTICIPATION IN ECUADOR AND ITS DETERMINANTS

## Introduction

Land is the most important asset in agricultural production and this activity still employs over 50% of the rural economically active population in Ecuador.[1] Land inequality and abundant availability of labor in a context of generalized unemployment suggest that an important means of reducing inequality would be by increasing access to agricultural land by the rural poor. There is, however, a lack of dynamism in the land markets. Large landowners do not make enough land available through sales or rentals to the land poor so as to satisfy the latter's demand for land (see Lambert and Stanfield, 1990 about land market segmentation). This situation seems to be encouraged by a number of factors that are worthy of study.

Decisions to supply land in the land market depend on a variety of factors that first affect land reservation prices (or reservation rents). Households that supply land in the sales market may be those facing financial distress or may be households upgrading to better land or deciding to migrate to the cities for better economic opportunities. Households offering land in the rental market may be behaving as risk averse (Currie, 1981) or may be households experiencing a temporary or permanent change in their supply of family labor; for example, those households that become female-headed after the male heads migrate out of the country to find a job that would provide more and secure income to send to their family back home.

Changes in the macroeconomic situation affecting the relative profitability of agriculture often put rural households in the position of choosing between participating in the land market or not (Currie, 1981), as do severe climatic conditions. Given the presence of market imperfections,

[1] Jordan (2003) notes that for the decades of the 1980s and 90s about 40% of the economically active population in the rural sector was working in non-agricultural activities, which reveals a loss of importance of land as a focus of household reproduction in the rural sector compared to earlier decades.

for those households facing harsh economic circumstances, their wealth level as well as their ability to access credit and affordable technical assistance could make a difference between selling their land or not.

Demand for land is also affected by households' abilities to face uncertain economic conditions, imperfections in rural markets and risk aversion. In addition, unequal land distribution and certain characteristics of the land market, such as market segmentation by class and kinship, may also influence how active land markets are and what type of individuals participate.

In spite of the accomplishments of the agrarian reform in Ecuador,[2] the available data shows that agricultural land continues to be highly concentrated in the hands of a few large landowners (Nieto, 2004). The last agrarian census (2000) reveals that agricultural production units (UPAs) of less than 2 hectares (ha.) constitute 43.4% of the total and they hold 2% of the cultivable land. In contrast, units of over 100 ha. represent 2.3% of the UPAs, while they control 43% of the land. Since the 1994 land law was approved land redistribution efforts have been left to the market (Santos-Ditto, 1999; Jordán, 2003). Given current restrictions on renting land (Chapter 2), rural market imperfections and land distribution results from the last agrarian census, the answer to the question of how well the land market can perform the redistribute task seems to be: not so well.

The literature on land market participation in Latin America is relatively recent (Deere and León, 2001) with important empirical studies having been carried out in Nicaragua (Deininger et

[2] The main achievements of the agrarian reform (1964-79) were that it eliminated precarious forms of labor, such as feudal-like or servile relations on haciendas. It also changed the agrarian structure by eradicating the latifundia (Jordan, 2003; Santos-Ditto, 1999; FAO-COTECA, 1995) and facilitating land access to peasant producers and to some indigenous communities of the highlands (FAO-COTECA, 1995). Even though the agrarian reform redistributed some land, most of the land adjudications were of state lands in the Amazon basin for colonization purposes (new settlements). Chiriboga (1998) notes that by 1994 the State had redistributed only 9.3% of Ecuador's cultivable land, benefiting 9.5% of the rural households; while 68.9% of the cultivable land was adjudicated to 9.9% of the households for colonization purposes.

al., 2003; Boucher et al., 2005), Honduras (Boucher et al., 2005; Carter and Salgado, 2001) and Paraguay (Masterson, 2005; Carter and Salgado, 2001). These studies aim to understand the role of the land sale and rental markets in asset inequality, and explore the factors that encourage land market participation.

In Ecuador, comprehensive studies of the rural land markets (FAO-COTECA, 1995; Lambert and Stanfield, 1990; Jordan, 2003) are few, qualitative rather than quantitative, and are based on data mainly up to the 1980s. These studies are compilations of more local studies and they show the effects of the agrarian reform on land distribution and the role assigned to the market after the reform period, together with an evident decrease in governmental intervention. They also note two different results with respect to small farmer participation in land markets: 1) their propensity to sell land – contributing to the increased tendency towards the formation of *minifundios*-; and 2) individuals who have succeeded in agriculture have been able to buy land and advance towards becoming medium capitalized units, especially in the more productive regions. These studies also emphasize the decline in the importance of agriculture as the main source of income for rural families and the difficult path out of poverty, as well as the marked social differentiation among small and large farmers which worsens the segmentation of rural markets.

Rural household data for the period October 1998 to September 1999 give us a window to observe the incidence of land market participation in Ecuador. In this chapter we use a quantitative approach and test the conclusions of the above mentioned Latin American studies in the case of Ecuador by examining the determinants of households' decisions to purchase, sell, rent in or rent out their land.

## Data and Methodology

### Land Supply

Supply in the land market can be in the form of land sales or leasing. Landowners have the option of putting all their land into production (or none at all), leasing it all, selling it all, or doing a combination of the three. The factors that influence landowners' choices among those alternatives are analyzed here. We use data from the Living Standard Measurement Survey carried out in Ecuador during October 1998 to September 1999. The data show that out of 1,738 landowners (90% of all farm operators) only 4.8% chose to rent out at least a portion of their land and 1.4% chose to sell at least a portion.[3]

In the analysis below we use multinomial logit[4] regression analysis by making the landowning households' alternatives mutually exclusive between farming all land, leasing at least a portion or selling at least a portion. For households leasing and selling land at the same time, we categorize the household according to whether the largest portion of land was leased or sold. Our model is as follows:

$$\begin{aligned} OwnerDecision = {} & \beta_0 + \alpha_i Coast + \beta_i NonUrban + \beta_i AgCon + \beta_i SizePrior + \\ & \beta_i \%Titled + \beta_i ValueAssets + \beta_i AniW + \beta_i Adults + \beta_i Credit + \\ & \beta_i Age + \beta_i Edu + \beta_i Female + \beta_i OffInc + \beta_i NonLInc + u \end{aligned} \tag{4-1}$$

Owner-decision refers to the owner's choice of renting out or selling at least a portion of the land. The comparison group is made up by households who exploit all or do nothing with their land. In addition, we break up the 'rent out' category in two subcategories describing the type of rental arrangements made by the landlord, namely, fixed rental or sharecropping. Thus

[3] Some of the households renting out also rented in some land so the percentage of net lessors was 4.6. Similarly, some of the seller households also purchased land, hence 1.3% of the landowners were net sellers.

[4] Logit regressions estimate log-odds, that is, $\log\left(\frac{\pi(x)}{1-\pi(x)}\right) = \alpha + \beta x$. See Agresti (1996).

we run two multinomial logit regressions where the dependent variable outcomes outside the comparison group (owner-operator only) are (a) rented out or sold, and (b) rented under fixed-rental contracts, rented under shared-rental contracts, or sold. Following Deininger et al. (2003) and Masterson (2005) we also run censored Tobit regressions so as to check the effect of the same variables included in the multinomial logit regressions on the amount of land sold and rented out.

The independent variables included in (1) are

- *Coast* = dummy variable for households in the coastal region (base: Sierra)
- *NonUrban* = dummy variable for households located in non-urban areas (base: urban)
- *Agcon* = dummy variable for households in areas of agricultural concentration (counties in which over 50% of the land is in production)
- *SizePrior* = amount of land owned prior to selling
- *%Titled* = percentage of owned land holdings with title
- *ValueAssets* = value of machinery and equipment (in 100 U.S. Dollars)
- *AniW* = value of animal stocks (in 100 U.S. Dollars)
- *Adults* = number of adult members in the household (14 or older)
- *Credit* = dummy variable indicating households who received any type of credit for a positive interest rate
- *Age* = years of age of the household head
- *Edu* = years of schooling of the household head
- *Female* = dummy variable for female household heads (base: male)
- *OffInc* = share of off-farm income relative to total household income
- *NonLInc* = share of income from remittances and governmental or non-governmental transfers relative to total household income

The amount of land owned prior to selling (*SizePrior*) would give us a first sign on the role of the land market on land inequality. A positive effect of this variable on land sales would suggest that, for the year of the survey, larger farmers contributed by offering land in the market[5]

[5] We could not easily conclude from a positive effect that Ecuador moved towards a more egalitarian land distribution during the time of the survey because we have no information on who these households sold land to. However, a positive result would suggest the presence of incentives to sell land by large owners and hence a stimuli to small farmers (or to the landless) to buy could successfully improve land distribution. The lack of information on who the households sold to is of importance given the evidence of land market segmentation by class and kinship in Ecuador (Lambert and Stanfield, 1990), a phenomenon usually observed throughout Latin America, where land inequality is a prevalent characteristic (Carter and Salgado, 2001; Deininger and Binswanger, 2001).

while a negative sign would reflect a reluctance to do so –likely due to non-productive reasons (Deininger et al.2003)-, and a more active participation by small farmers. The effect of this variable on the supply of land has been analyzed for the cases of Nicaragua (Deininger et al., 2003, for the year 1998) and Paraguay (Masterson, 2005, for the year 2001) with different results, namely, a negative effect on the amount of land sold in the case of Nicaragua, while positive results on incidence and amount of land sold in Paraguay.

In the case of Ecuador, it is probable that the tendency to sell by small farmers who acquired land during the agrarian reform period continued during the year of the survey (1998-1999). This behavior by small farmers was evident after the fragmentation of production cooperatives, especially since the new land law, which removed restrictions for land sales, was issued in 1994 (FAO-COTECA, 1995; Santos-Ditto, 1999; Nieto, 2004). Also, Table 4-1 shows that 56% of the land sales were performed by households holding less than 5 ha.

On the rental market, the effect of the area owned was positive for the amount of land supplied in both the Nicaragua and Paraguay cases. Also, Boucher et al. (2005), using pair-wise analysis, show that the incidence of land supply in the rental market was higher the larger the amount of land owned both in Honduras in 2000 and Nicaragua in 1999. In Ecuador, Table 4-2 shows that the majority of households supplying land in the rental market were again those owning less than 5 ha. (71%).

However, farms of 5 to less than 40 hectares represented an important share of the land suppliers, especially in the sales market and in the rental market under fixed-rental contracts. Also, in the latter case, those households offered on average significantly more land than smaller farmers.

In Table 4-2 we can also see that sharecropping was more popular among households owning less than 5 ha., while those owners of 40 or more ha. that chose this type of rental agreement dedicated on average less land area to this purpose compared to smaller farms and especially compared to farms using fixed-rental contracts.

There are no clear prior expectations on the effect of the share of titled land (*%Titled*) on landowners' decisions to participate in the land market. Land titles could stimulate more profitable own production due to credit access and security for investment (Feder et al., 1988) or could facilitate participation in the rental market.[6] Land titles could also facilitate land sales, especially by poor households who are credit constrained (Chapter 3).[7] These may be agrarian reform beneficiaries selling land after land titling programs were implemented (Deere and León, 2001; Deininger and Binswanger, 2001; Carter and Salgado, 2001).[8]

The number of adults (*Adults*) in the household and the value of farm equipment (*ValueAssets*), as well as the value of animal stocks (*AniW*) should increase the likelihood of farming compared to renting out or selling land since more of these factors increase the advantage of farm producers. On the contrary, we expect older household heads to have higher odds of selling or renting out given their decreased labor/management efficiency (Chapter 3) compared to younger heads. More educated household heads would also be more likely to rent

[6] The importance of land titles for the supply side of the land rental market in Ecuador has already been discussed in our first essay (see also Boucher et al., 2005 on Honduras and Nicaragua).

[7] In the case of Paraguay, Carter and Salgado (2001) explain how land titles were unsuccessful in releasing credit constraints for small farmers, similar to what Boucher et al. (2005) found in Honduras and Nicaragua. Given the role of land titles in reducing transaction costs for land sales (Boucher et al., 2005), what land titles may lead to is land sales by small farmers.

[8] Since the LSMS survey did not provide land title information on land sold, we assumed here that the percentage of land still held by the household at the time of the survey that was titled is a good proxy of such percentage at the time the land sales occurred.

out or sell than to produce as the opportunity cost of their labor is higher and therefore they would look for more profitable opportunities off-farm.

Landowner households with larger shares of off-farm income (*OffInc*) may also prefer to rent out or sell depending on the household's composition. In other words, off-farm income can be a good source of financing for agriculture; however, this depends on the total amount of labor hours available in the household and the amount dedicated to earning off-farm income. In the case of non-labor income (*NonLInc*), that is, income from remittances and/or governmental or non-governmental transfers, those households receiving larger shares of this type of income may be poor households more likely to farm all land rather than rent out or sell, although for households whose skilled labor has migrated, renting out (or even selling) may be their choice.

The sex of the household head (*Female*) is also included here in order to observe the effect of gender on the decisions to participate in the land market. The participation of women in Ecuadorian agriculture is such that, according to the latest agrarian census (2000), 25.4% of farm producers in Ecuador are women, 30.5% in the Sierra and 14.8% in the Coast. Also, our data indicate that 16% of the landowning households were headed by women (Table 4-3), 19% in the Sierra and 9% in the Coast. This reflects the importance of women in agricultural production but also suggests that women are underrepresented as principal agriculturalists in our data set, especially in the Sierra.

Nonetheless, as noticed by Deere and León (2001), in Latin America rural women face disadvantages when trying to access services like credit, technical assistance and marketing compared to men. Therefore, they may be less competitive than male farmers, which may lead them to be more likely to sell or rent their land than men. This aspect, however, may be less important than it seems in the decision of women to participate in the land market as sellers

because of the additional benefits that landownership brings them. Namely, ownership of land increases the bargaining power of women in the household and the community; it provides food security for their children and it constitutes an asset suitable for renting so as to generate income for the household (Deere and León, 2001, pp. 327:329).

Hence, female headed households may or may not be more likely than male headed households to sell, however they may be more likely than men to rent out rather than to farm the land themselves. We expect to find the latter result especially given the overrepresentation of female headed households among households who rented out some land in our data set, compared to the share of female heads among all landowning households (Table 4-3).

We also need to be aware of the dynamics of migration by gender in Ecuador and the possible consequences this could have on the effect of the gender variable on the decision to farm, sell or rent out. In the leading provinces in international migration in Ecuador –which are in the Sierra-, the migrating population is mainly made up by poor rural men (Camacho, 2005; FLACSO and UNFPA, 2006). This migration of poor rural men, whose income-generating activities are mostly related to agriculture (Camacho, 2005), leaves their wives in the position to choose between farming the land under their own management, leasing it in some form, or getting rid of the land. The fact that the year 1999 witnessed a large increase in the migrating population (Camacho, 2005) may have influenced female household heads' decisions to participate in the land market.

In addition, harsh economic conditions in the agricultural sector due to, among other things, weather phenomena such as happened with the effect of the El Nino phenomenon on the Coast during 1997-1998, may have lead to some land sales, especially by female headed households in 1998-1999, the year of our data set.

Access to credit (*Credit*) is also included in our model as it could make a difference between farming, renting out or selling. Also, if renting out is the choice, landowners who obtained credit could opt for sharecropping where they would provide a share of the inputs and the tenants, the labor.

Based on Chapter 3 we also hypothesize that capital constrained households (i.e., those who needed credit but were not able to obtain it) would be more likely to sell the land than unconstrained households (i.e., those who got credit or did not need it) because of the former's lower land reservation price. When testing for this we replace the credit variable with the non-price rationed dummy variable.

Nevertheless, looking at Table 4-3, it is interesting to notice that over 33% of the households who sold some land reported to have obtained some type of credit during the year of the survey (38% of these cases obtained credit for agricultural purposes). This share is much higher than for all landowners or those who farmed only. Nevertheless, the average share of sold land was smaller for households with credit (25% of total land) than for those without (38% of total land).

**Land Demand**

Demand for land can be observed in the form of land purchases or as land rented in. With respect to land purchases, our interest is in landowner households who bought land during the year prior to the survey. These households correspond to 2% (1.9% net buyers) of the landowners in the data set. We expect the same variables included in model (1) to affect model (2) below, except for the percentage of titled land, which is not included here since it should only affect supply and not the general demand for land (Deininger et al., 2003).

$$Purchased = \beta_0 + \beta_i Coast + \beta_i NonUrban + \beta_i AgCon + \beta_i SizePrior + \beta_i ValueAssets + \beta_i AniW + \beta_i Adults + \beta_i Credit + \beta_i Age + \beta_i Edu + \beta_i Female + \beta_i OffInc + \beta_i NonLInc + \beta_i Tenant + v \quad (4\text{-}2)$$

Model 4-2 will be estimated as a simple logit regression where *Purchased* is a binary variable representing incidence of land purchases during the twelve months prior to the survey. The effect of the amount of land owned prior to purchase on the likelihood of buying land and especially on the amount of land purchased will tell us how disadvantaged the rural poor are in the land market. In the case of Paraguay (for 1991-94), for example, Carter and Salgado (2001) found a direct relationship between the land to labor endowment ratio and the probability of purchasing land. In our case, however, although the total incidence of land purchases is again small as in the case of land sales, the land poor seem to have been more active in the land market compared to larger farmers.

Table 4-4 shows that an important number of households who purchased land were landless prior to purchase (41%)[9] and that 53% were owners of less than 5 ha., while no large owner (40 hectares or more) performed any purchase. Nonetheless, 72% of the land purchases by households with less than 5 ha. were only of less than 1 ha. and so were 43% of the purchases by the landless prior to purchase.

Assuming that in female headed households the landowner is actually a woman, [10] these households may have been less likely to buy land than male headed households. This is because, as analyzed by Deere and León (2003), in Latin America the land market is not the most

[9] This is, however, a heterogeneous group of people which seems to contain wealthier, urban households entering into the agricultural sector, as well as poor rural households being able to acquire some land. As such, 21% (or 3 households) of the landless prior to purchase acquired between 24 and 63 ha. during the year prior to the survey.

[10] We need to make this assumption because the 1998-1999 LSMS survey did not gather data on landownership by gender. This is a shortcoming of most LSMS questionnaires designed for Latin America and it has been addressed in Doss et al. (2007).

important channel of land acquisition for women; instead, inheritance is. Yet, these authors note that Ecuador is an exception due to the large share of women who obtained land through the market compared to other countries in the region.

Table 4-5 shows the most important form of land acquisition (50% of the land or larger) by gender based on our data set. There we can see that, like found by Deere and León (2003), inheritance and purchases are the most important form of land acquisition for women in Ecuador while the market is for men. The difference in the share of male headed households acquiring land through the market and that of female headed households is, however, very small (45.4% for male heads and 44.5% for female heads).

Credit access is expected to significantly increase the odds of purchasing land and the amount of land purchased. Table 4-6 shows that 50% of the households in our data set who purchased land obtained credit. This is a very large share compared to the total share of farmers (last column) who obtained credit. Looking closely at these land buyers with credit access, 59% of them reported to have obtained credit for agricultural purposes, 29% for household consumption and 12% obtained loans for both purposes. Credit was provided by institutional sources in 35% of the cases (private banks and cooperatives) while the rest was provided by family, friends or other informal lenders.

Given that credit is fungible, we thus expect that having access to loans in general would increase the likelihood and amount of land purchases. Particularly, 43% of the landless prior to purchase obtained credit during the same year they purchased land (most of which bought less than 2 ha.).

An additional explanatory variable in Equation 4-2 is the dummy *Tenant*, included with the purpose of testing the hypothesis that access to land through the rental market may help the rural

poor scale up the 'agricultural ladder' toward land ownership (Binswanger et al., 1995; Sadoulet et al., 2001).[11] The 'agricultural ladder' is a sequence of progress of a farmer that goes from being an agricultural worker to becoming a sharecropper, then perhaps a fixed rent tenant and finally a landowner. Even though the appropriate way of testing for this hypothesis is through the use of panel data (the same farmers being interviewed over time), we attempt to observe any contribution of tenancy to the probability of purchasing land in the year of our survey.

As such, we expect to find that tenant households had a higher likelihood of buying land during the year of the survey than households who did not rent in land. We expect this effect to be significant since 41% of the land buyers in our data set were also tenants (Table 4-6) as were 43% of the landless prior to purchase. It is also worth noticing that 86% of the tenant households in our data who purchased land during the year prior to the survey were also sharecroppers (as opposed to fixed-rent tenants). This is relevant given Lehman (1985)'s findings that sharecropping in the Province of Carchi, Ecuador was more a "capitalist partnership rather than…a form of tenancy (pp. 351)," and one which allowed capital accumulation by peasant producers.

On the determinants of the odds of renting in land and of the amounts of land rented in, we estimate Equation 4-3, again using logit and Tobit regressions. In addition, we run a multinomial logit so as to specifically observe the effect of the same variables on the likelihood to choose fixed-rental agreements, sharecropping or no rental agreement at all. The total number of farmers in our sample who were tenants is 497, which represents 25.6% of all the farmers in the sample. Of this, 76% chose shared-rental agreements.

[11] Authors like Sadoulet et al. (2001) and Binswanger et al. (1995) conclude that, given market imperfections, access to land through the rental market would allow poor farmers to accumulate knowledge and wealth, helping them to acquire land in the long-run.

$$RentIn = \beta_0 + \beta_i Coast + \beta_i NonUrban + \beta_i AgCon + \beta_i SizeOwned + \beta_i ValueAssets + \beta_i AniW + \beta_i Adults + \beta_i Credit + \beta_i Age + \beta_i Edu + \beta_i Female + \beta_i + OffInc + \beta_i NonLInc + e \quad (4\text{-}3)$$

Table 4-7a shows that 41% of the tenant households were landless and 53% owned less than 5 ha., so we see the land poor being more active than large farmers in the land rental market too. Similar to what we found on the supply side, households owning less than 5 ha. make up most of the sharecropping cases. Table 4-7b indicates that these households actually prefer sharecropping to fixed-rental contracts.

As was the case for those households who purchased land, the share of tenant households who obtained credit is also larger than this share for all farmers (Table 4-6). Among tenant households, 37% of the credit cases were for agricultural purposes, 40% for household consumption, 7% for family business and 16% for both agricultural and non-agricultural purposes.

Technical assistance as a dummy variable is not explicitly included in our regressions because of its low frequency in our data set (Tables 4-3 and 4-6) and especially due to its null incidence among households who rented out and those who purchased some land. However, we will comment on the effect of this variable on the multinomial logit of the land supply equation (model 1) and on the decision to rent in land (model 3). It is worth noticing here that 66% of those households with access to technical assistance chose to put all the land they owned into production; 20% had all of their own land in production plus rented in some land during the year prior to the survey, and 11% were tenants only. The positive impact of access to technical assistance on the demand for land is evident.

## Results

### Supply Side

Multinomial logit regression results in Tables 4-8a and 4-8b reveal that the effect of the amount of land owned prior to transactions on the likelihood of selling land was statistically significant but very small (only a 0.3%[12] increase in the likelihood to sell relative to farming all land per owned hectare increase). This variable also slightly influenced the odds of engaging in fixed-rental agreements (one more hectare of owned land increased the odds of choosing fixed rentals over farming oneself by 0.4% and the odds of choosing fixed rentals over sharecropping by 0.5%).

The share of titled land significantly affected only the odds of selling land. A one unit increase in this share would increase the likelihood of selling compared to farming all land oneself by 596%. This is the most important effect on the likelihood to sell land, which reveals the impact that land titling programs may have if not accompanied with policies aimed at releasing small farmers' credit constraints (Deininger and Binswanger, 2001), among other market imperfections.

Households located in non-urban areas were more likely to choose exploiting the land themselves rather than renting out compared to households in urban areas. This may be explained by the fact that urban households have more off-farm opportunities and therefore a higher opportunity cost of labor than rural households, hence they would prefer renting out more often. In addition, for households who chose to rent out (Table 4-8b), rural households were 153% more likely to choose sharecropping as the leasing arrangement rather than fixed rental payments.

[12] The effect of a variable is obtained as follows: exp( $\beta_i$ )-1 and is read as a percentage.

As expected, older household heads were more likely to rent out than to farm all land and more educated heads showed higher odds both of renting out and selling relative to farming all the land. Furthermore, more educated household heads were 4% more likely to sell than to rent out. More education raises labor opportunity costs, apparently leading to these results. Consistent with the effect of education, the share of off-farm income strongly increased the odds of choosing to rent out land over farming it.

Households receiving larger shares of income from remittances and/or governmental or non-governmental transfers are even more strongly likely to rent out compared to farming the land themselves. However, they are significantly less likely to sell than to farm all land (95% less likely) and also less likely to sell than to rent out (98% less likely). Since households with larger shares of non-labor income tend to be poor households, these results suggest their need for production support and their lower risk-bearing capacity. Furthermore, these households showed preference for sharecropping as the rental agreement, which is a sign that they want –and need- to be somewhat involved in the production process but they cannot do it all by themselves.

Female household heads had a 136% higher likelihood than male household heads of renting out under fixed-rental arrangements rather than farming all their land. In contrast, higher values of animal stocks would decrease the odds of choosing fixed-rentals over farming all land.

These results also show that households in the Coast were less likely to sell their land than farming compared to households in the Sierra. In addition, sharecropping was a much more predominant type of land rental in the Sierra than in the coastal region, where there were no cases of sharecropping (Table 4-3). The FAO-COTECA (1995:45) study observed the tendency of sharecropping to disappear on the Coast, especially in the rice growing areas. This region is known to have a more capitalist orientation than the Sierra (Jordan, 2003), which would support

these findings. Also, households in areas of agricultural concentration prefer farming to sharecropping. This behavior can also be explained by the more commercial orientation of such areas.

Also interesting to note from these results is that for households who rented out, one more year of schooling of the household head increased the odds of choosing sharecropping rather than fixed rentals by 4%. This result speaks to the benefits of sharecropping agreements. More educated household heads seem to prefer looking for jobs were their marginal value of labor is higher while allowing others (usually family or friends) to farm their land but still being partially involved in the production process so as to benefit from its profits.

On the determinants of the amount of land to be rented out or sold (Table 4-9), non-urban households rented out significantly less amounts of land than those located in urban areas (approximately 10 ha. less). Female household heads rented out about 5 more hectares than male heads, being the second strongest effect in this equation. Also consistent with results in Tables 8a and 8b, more educated household heads both rented out and sold more land, and older heads rented out more land.

Titled land facilitated land sales up to the point that a unit increase in the share of titled land increased the amount of land sold by 19 hectares and again this effect is the largest in the land sale equation.

Finally, when replacing the credit dummy variable with the non-price rationed dummy so as to identify the specific effect of being constrained in the credit market, we found that the new variable did not have a significant impact on the likelihood to sell. We also found that credit constrained households were 61% less likely (at 10% significance) to rent out their land rather than farming all compared to households who were credit unconstrained. This result must be a

consequence of credit constrained households being mainly poor households who own small plots of land and have abundant family labor (Chapter 3); hence they need to farm the land themselves as they would otherwise face unemployment.

**Demand Side**

On the demand side of the land market (Table 4-10), we see again that households in the Coast were not very active in the land sales market compared to those in the Sierra. In fact, the estimated odds of a household from the coastal region purchasing land were 85% lower than those for a household from the highlands. Since the mean size owned prior to purchase in the Coast (13 ha.) is almost twice as high as that in the Sierra (7 ha.) and, as shown in Table 4-4, transactions were mainly performed by small farmers, this result makes sense.

As expected, the size owned prior to purchase has a negative effect on the likelihood to purchase land and this effect is much stronger than the positive influence of this variable found on the supply side of the land market. More specifically, one more unit of land would decrease the odds of buying land by 16%.

Also as expected, access to credit was highly significant with a strong effect on the likelihood of buying land and on the amount of land purchased (the strongest effect in both equations). More specifically, households who had access to any type of credit (for a positive interest rate) were 253% more likely to purchase land than households who did not obtain credit. Also, households who got credit were able to buy 9.6 more hectares than those without credit. This result has important implications for rural development, such that, even if land credit is not readily available, increasing the general supply of credit for the rural poor would contribute towards land acquisition.

The dummy *Tenant* also had a positive and significant effect on the incidence of land purchases. A tenant household had 148% higher estimated odds of purchasing land than a non-

tenant household. This result provides some evidence that tenant households are in a better position than non-tenant landless households to become landowners and than non-tenant landed households to purchase more land. Hence, the importance of the land rental market in providing [progressive] land access to the rural poor is stressed here.

These results also show that the values of farm equipment and animal stocks had a positive effect on the likelihood of purchasing land and the effect of the latter was significantly stronger than that of the former (6% versus 1% increase per $100 increase in animal stocks and farm assets, respectively). This reveals the importance of farm animals as 1) work animals and 2) a form of financial security for the rural poor. In addition, older household heads were less likely to buy land and if they did, it was in smaller amounts than younger household heads.

The main determinants of demand in the land rental market are specified in Tables 4-11 and 4-12. Areas of agricultural concentration were more active in the land rental market than other areas but, consistent with our earlier results on the supply side, households in these areas prefer fixed-rental agreements rather than sharecropping. Similarly, households in the Coast were more active in the fixed-rental market and less in the shared-rental market compared to the Sierra.

As expected, more hectares of owned land would reduce the likelihood of renting in land (18% decrease per ha. increase). This effect is again stronger than that of the same variable on the supply side of the land rental market. The amount of land owned also reduced the odds of choosing sharecropping agreements (24% per ha. increase). Also, one more hectare of land owned would reduce the amount of land rented in by 0.21 ha.

While female household heads were not significantly less likely to purchase land, they were significantly less likely to rent in land than male heads (37% less likely). Moreover, female

heads rented in 1.2 less ha. and were 40% less likely to rent land as sharecroppers compared to male heads.

Consistent with our results on the supply side, older and more educated household heads were less likely to rent in land and rented in less land than households with younger, less educated heads. Also, the share of off-farm income reduced the amount of land rented in.

The value of animal stocks increased the odds of renting in and the amount of land rented (a $100 increase in animal stocks, would increase the odds of renting in by 3% and the amount of land rented in by 0.08 ha.). The value of farm equipment also increased the amount of land rented in but with a smaller effect than the value of farm animals. Interestingly, a $100 increase in farm assets would increase the odds of choosing sharecropping by 0.8%. This effect, although small, suggests the relative importance of owning farm assets for sharecropping arrangements. This conforms to what is noted by Sadoulet et al. (2001): "with increasing capital-intensity in agriculture, landlords look for tenants who can help share capital costs. (pp.210)," and to what noted by Lehman (1986), that sharecropping is more a partnership rather than a precarious work relationship in certain areas of Ecuador.

Once again, the credit dummy was positive and highly significant, being the largest effect in both logit and Tobit regressions. As such, households who obtained credit had 107% higher estimated odds of renting in land and rented in 2 more hectares than households without credit. The direction of this effect was true for both types of rental agreements; however there was preference for fixed-rentals by households with credit access (19% higher odds of choosing fixed-rental agreements rather than sharecropping).

Also, households with more adult members had higher odds of renting in land (13% per adult member increase) especially under fixed-rental agreements (21% increase). One more adult

in the household increased the amount of land rented by half hectare. The effects of this variable reflect the need for land in a context with land inequality, abundant labor and generalized unemployment.

Finally, when including technical assistance in our analyses we found that, as expected, households with access to this service were significantly less likely to rent out rather than to farm all the land, and were more likely to rent in.

## Conclusions

Our results show that the incidence of land sales and purchases in Ecuador was low during the period from late 1997 (year prior to the first day of the survey) to late 1999. We also found that the amount of land owned prior to these transactions influenced participation in the land sales market; however, the effect on the supply side was minimal while that on the demand side was much stronger. Similar is the case in the land rental markets, where larger landowners were only slightly more likely to rent out but significantly less likely to rent in. Hence, although there was some indication by large owners of their willingness to offer land in the land markets, the demand, which was mainly performed by the land poor, seemed to be largely unsatisfied.

Conforming to the abundant availability of labor and the need for land by the rural poor, we found that the number of adult members in the household had a significant effect on the odds of renting land in and on the amounts of land rented. The importance of active land rental markets was also perceived in that tenancy contributed significantly toward land purchases.

The share of titled land was the most important determinant of participation in the land market as a seller. This reflects the role of land titles in reducing transaction costs on land sales and the effect land titling programs may have on poor landowners if not accompanied by policies aiming to remove relevant market imperfections, especially those found in the credit market.

On the demand side, credit access was the strongest determinant of land market participation both in the land asset and the rental market. This conclusion on the significance of credit for land market participation is also noted by Masterson (2005), Boucher et al. (2005) and Carter and Salgado (2001). A good portion of credit in our Ecuadorian case was obtained for non-agricultural purposes, hence suggesting that increasing the general supply of credit in the rural sector could contribute to more active land markets.

In addition, taking into account that households with larger shares of non-labor income tend to be poor households, this type of income was observed to contribute to land access by the rural poor in that it decreased the likelihood of selling land and increased the odds of leasing, which provides land access for landless or other landed households. Hence, this paper showed some evidence that funds coming from remittances and governmental or non-governmental transfers help the rural poor hold on to their land. Furthermore, the fact that these households strongly preferred sharecropping (rather than selling or farming all land) as the type of rental arrangement may also reveal that they want to be involved in the production process but are not able to farm all the land by themselves, thus showing the need for production support.

The probable lower competitiveness of female household heads in agricultural production was perceived by their higher odds of renting land out under fixed-rental contracts, their lower odds of renting in, and their larger amounts of land rented out and lower amounts of land rented in. The participation of female household heads in the supply side of the land rental market may have been a strategy to secure income for their families -at the same time as perhaps they sold their labor in off-farm activities-, however, it may have also been the result of male migration from their households or harsh economic conditions after severe weather (El Nino in 1997-98) -or a combination of both.

Finally, the land sales market was less active on the Coast than it was in the Sierra. Given that owners of less than 5 ha. and the landless prior to purchase were the ones who performed most of the land purchases (Table 4-4), this difference between regions is probably due to the larger degree of land concentration on the Coast; while small farms predominate in the Sierra. Also, landed households in the Coast and those located in areas of agricultural concentration were significantly less likely to engage in sharecropping as opposed to farming all their land or choosing to rent out under fixed-rental contracts, which can be justified by the more commercial orientation of these areas.

In conclusion, the rural poor seem to be the most active on the demand side of the land sales and rental markets in Ecuador. However, given difficulties that prevent desired land transfers from large landowners to the rural poor –such as transaction costs for large owners, who must subdivide their holdings in order to sell smaller plots (Carter and Zegarra, 2000), and the unsatisfied need for credit by the rural poor-, it seems improbable that the market will be able to achieve an optimal land distribution without any assistance from the government.

Table 4-1. Farm size and land sales by owned land category

| | Owned prior to selling | | | |
|---|---|---|---|---|
| Farm size category (ha.) | N | % | Mean owned | Mean sold |
| Less than 1 | 6 | 24 | 0.36 | 0.10 |
| >=1 to <5 | 8 | 32 | 2.76 | 0.76 |
| >=5 to <40 | 8 | 32 | 11.45 | 2.41 |
| >= 40 | 3 | 12 | 113.67 | 76.67 |
| Total seller households | 25 | 100 | 18.27 | 10.24 |

Table 4-2. Incidence of land rentals (landlords) by owned farm size category

| | Rented out | | | | Fixed-rent | | | | Shared-rent | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Farm size category (ha.) | N | % | Mean owned | Mean rented | N | % | Mean owned | Mean rented | N | % | Mean owned | Mean rented |
| Less than 1 | 30 | 36 | 0.5 | 0.4 | 12 | 35 | 0.5 | 0.4 | 18 | 37 | 0.4 | 0.4 |
| >=1 to <5 | 29 | 35 | 2.2 | 1.6 | 9 | 27 | 2.2 | 1.8 | 20 | 41 | 2.2 | 1.6 |
| >=5 to <40 | 20 | 24 | 11.7 | 9.6 | 11 | 32 | 14.1 | 10.5 | 9 | 18 | 8.8 | 8.6 |
| >= 40 | 4 | 5 | 93.0 | 50.8 | 2 | 6 | 100.0 | 100.0 | 2 | 4 | 86.0 | 1.5 |
| Total renters (landlords) | 83 | 100 | 8.2 | 5.5 | 34 | 100 | 11.2 | 9.9 | 49 | 100 | 6.2 | 2.4 |

Table 4-3. Mean and median statistics of variables in Equation 4-1

| Owner decisions | Total landowners | | Farmed only | | Sold | | Rented out | | Shared-rent | | Fixed-rent | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 1738 | | 1629 | | 25 | | 83 | | 49 | | 34 | |
| | # or mean | % or median | # or mean | % or median | # or mean | % or median | # or mean | % or median | # or mean | % or median | # or mean | % or median |
| Coast | 458 | 26.4% | 439 | 26.9% | 3 | 12.0% | 16 | 19.3% | 0 | 0.0% | 16 | 47.1% |
| Sierra | 1280 | 73.6% | 1190 | 73.1% | 22 | 88.0% | 67 | 80.7% | 49 | 100.0% | 18 | 52.9% |
| Agricultural concentration area | 627 | 36.1% | 600 | 36.8% | 8 | 32.0% | 19 | 22.9% | 4 | 8.2% | 15 | 44.1% |
| Urban | 172 | 9.9% | 138 | 8.5% | 8 | 32.0% | 26 | 31.3% | 14 | 28.6% | 12 | 35.3% |
| Non-urban | 1566 | 90.1% | 1491 | 91.5% | 17 | 68.0% | 57 | 68.7% | 35 | 71.4% | 22 | 64.7% |
| Size owned prior to transactions | 8.61 | 1.06 | 8.48 | 1.01 | 18.27 | 4.05 | 8.23 | 1.41 | 6.17 | 1.06 | 11.19 | 1.8084 |
| Percent titled | 0.65 | 1.00 | 0.64 | 1 | 0.90 | 1 | 0.73 | 1 | 0.80 | 1 | 0.62 | 1 |
| Value of farm assets | 338.32 | 25.80 | 347.85 | 26.85 | 678.96 | 47.98 | 52.61 | 4.47 | 61.62 | 7.03 | 39.62 | 0 |
| Adults | 3.13 | 3.00 | 3.13 | 3 | 3.36 | 3 | 3.18 | 3 | 3.06 | 3 | 3.35 | 3 |
| Credit | 289 | 16.7% | 262 | 16.1% | 8 | 33.3% | 19 | 23.5% | 11 | 22.9% | 8 | 24.2% |
| Age of head | 50.37 | 49.00 | 50.13 | 49 | 50.32 | 48 | 55.07 | 54 | 55.82 | 55 | 54 | 50.5 |
| Education of head | 4.24 | 4.00 | 4.13 | 4 | 7.04 | 6 | 5.54 | 5 | 5.24 | 5 | 5.97 | 5 |
| Male | 1456 | 83.8% | 1374 | 84.3% | 21 | 84.0% | 60 | 72.3% | 36 | 73.5% | 24 | 70.6% |
| Female | 282 | 16.2% | 255 | 15.7% | 4 | 16.0% | 23 | 27.7% | 13 | 26.5% | 10 | 29.4% |
| Off-farm income | 1516.14 | 817.12 | 1375.05 | 785.76 | 9116.59 | 712.91 | 2006.73 | 1278.69 | 1886.20 | 1005.17 | 2176.90 | 1594.79 |
| Non-labor income | 146.44 | 29.69 | 144.61 | 30.12 | 58.00 | 6.22 | 211.51 | 41.87 | 234.18 | 35.14 | 179.49 | 43.12 |
| Remittances | 276 | 15.9% | 249 | 15.3% | 3 | 12.0% | 24 | 28.9% | 15 | 30.6% | 9 | 26% |
| Technical assistance | 31 | 1.8% | 30 | 1.8% | 1 | 4% | 0 | 0% | 0 | 0% | 0 | 0% |
| % of landowners who… | | | 93.7% | | 1.44% | | 4.78% | | 2.82% | | 1.96% | |
| Net sellers or renters | | | | | 1.27% | | 4.60% | | | | | |
| Size produced, sold or rented-out | | | 8.48 | | 10.24 | | 5.47 | | 2.41 | | 9.88 | |

Table 4-4. Farm size and land purchases by owned land category (prior to purchase)

| | Owned prior to purchase | | | |
|---|---|---|---|---|
| Farm size category (ha.) | N | % | Mean owned | Mean purchased |
| *Landless* | 14 | 41 | -- | 11.66[1] |
| Less than 1 | 7 | 21 | 0.44 | 0.46 |
| >=1 to <5 | 11 | 32 | 2.19 | 0.81 |
| >=5 to <40 | 2 | 6 | 14.03 | 11.56 |
| >= 40 | 0 | 0 | -- | 0 |
| Total buying households | 34 | 100 | | 5.84 |

Table 4-5. Forms of land acquisition by gender

| | Female HH | | Male HH | | Total* | |
|---|---|---|---|---|---|---|
| Main form of acquisition | N | % | N | % | N | % |
| Purchased during last year | 3 | 1.1 | 19 | 1.3 | 22 | 1.3 |
| Purchased earlier | 122 | 43.4 | 633 | 44.1 | 755 | 43.9 |
| Inherited | 129 | 45.9 | 541 | 37.6 | 670 | 39.0 |
| Adjudicated | 11 | 3.9 | 95 | 6.6 | 106 | 6.2 |
| Usufruct | 16 | 5.7 | 149 | 10.4 | 165 | 9.6 |
| Total landowners | 281 | 100.0 | 1437 | 100.0 | 1718 | 100.0 |

* 20 households (1 female headed and 19 male headed) reported a mixture of any two forms of acquisition (50 and 50%) and so were not included in this table.

[1] This average goes down to 2.9 ha. when not taking into account the 3 households with the largest land purchases.

Table 4-6. Summary of variables in Equations 4-2 and 4-3

| | Purchased | | Rented-in | | Total farmers | |
|---|---|---|---|---|---|---|
| Total incidence | 34 | | 497 | | 1940 | |
| | # or mean | % or median | # or mean | % or median | # or mean | % or median |
| Coast | 4 | 11.8% | 132 | 26.6% | 537 | 27.7% |
| Sierra | 30 | 88.2% | 365 | 73.4% | 1403 | 72.3% |
| Agricultural concentration area | 10 | 29.4% | 200 | 40.2% | 720 | 37.1% |
| Urban | 5 | 14.7% | 44 | 8.9% | 207 | 10.7% |
| Non-urban | 29 | 85.3% | 453 | 91.1% | 1733 | 89.3% |
| Size prior to purchase | 1.62 | 0.27 | | | | |
| Total owned | | | 1.53 | 0.18 | 7.57 | 1 |
| Value of farm assets | 441.34 | 48.80 | 256.14 | 29.52 | 321.37 | 23.43 |
| Adults | 3.06 | 2.50 | 3.18 | 3 | 3.11 | 3 |
| Credit | 17 | 50.0% | 119 | 23.9% | 328 | 16.9% |
| Age of head | 39.82 | 38.5 | 44.95 | 44 | 49.53 | 49 |
| Education of head | 6.56 | 6 | 4.27 | 4 | 4.25 | 4 |
| Male | 31 | 91.2% | 444 | 89.3% | 1633 | 84.2% |
| Female | 3 | 8.8% | 53 | 10.7% | 307 | 15.8% |
| Off-farm income | 1937.72 | 944.87 | 1352.88 | 876.20 | 1509.58 | 843.29 |
| Non-labor income | 532.59 | 16.93 | 113.54 | 110.87 | 143.32 | 38.39 |
| Tenant | 14 | 41.2% | | | | |
| Remittances | 6 | 17.6% | 57 | 11.5% | 300 | 15.5% |
| Technical assistance | 0 | 0% | 11 | 2.2% | 35 | 1.8% |
| Size purchased | 5.84 | 0.71 | | | | |
| Size rented-in | | | 2.22 | 0.71 | | |
| % of current owners (1,738) who bought land | | 1.96% | | | | |
| Net buyers | | 1.90% | | | | |
| % of farmers (1,940) who rented-in | | | | 25.6% | | |
| Net tenants | | | | 25.5% | | |
| % of tenants who owned land | | | | 59.4% | | |

Table 4-7a. Land rented in by category of land owned

| | Total | | | | Fixed-rent | | | | Shared-rent | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Farm size category (ha.) | N | % | Mean owned | Mean rented | N | % | Mean owned | Mean rented | N | % | Mean owned | Mean rented |
| *Landless* | 202 | 41 | | 2.6 | 54 | 45 | | 3.9 | 154 | 41 | | 2.2 |
| <1 | 153 | 31 | 0.3 | 1.1 | 18 | 15 | 0.4 | 1.0 | 132 | 35 | 0.3 | 1.2 |
| >=1 to <5 | 110 | 22 | 2.1 | 1.9 | 31 | 26 | 2.1 | 2.0 | 77 | 20 | 2.1 | 1.8 |
| >=5 to <40 | 29 | 6 | 11.7 | 5.4 | 15 | 13 | 11.2 | 7.2 | 13 | 3 | 12.0 | 3.0 |
| >= 40 | 3 | 1 | 47.3 | 11.8 | 2 | 2 | 45.0 | 15.8 | 1 | 0.3 | 52.0 | 4.0 |
| Total renters | 497 | 100 | 1.5 | 2.2 | 120 | 100 | 2.8 | 3.6 | 377 | 100 | 1.1 | 1.8 |

Table 4-7b. Choice of rental agreement by category of land owned

| Farm size category (ha.) | N | % fixed-rent | % shared-rent |
|---|---|---|---|
| *Landless* | 202 | 27 | 76 |
| Less than 1 ha. | 153 | 12 | 86 |
| 1 to less than 5 ha. | 110 | 28 | 70 |
| 5 to less than 40 ha. | 29 | 52 | 45 |
| 40 or more ha. | 3 | 67 | 33 |
| Total renting households | 497 | 24 | 76 |

Table 4-8a. Multinomial logit regression results (owners' decisions between farming, selling or renting out)

| Variables | Sell/ Farm | | | Rent-out / Farm | | |
|---|---|---|---|---|---|---|
| | Coefficient | | Robust SE | Coefficient | | Robust SE |
| *Coast* | -1.568 | * | (0.882) | -0.315 | | (0.367) |
| *NonUrban* | -0.571 | | (0.667) | -0.848 | ** | (0.377) |
| *Agcon* | 0.164 | | (0.537) | -0.342 | | (0.304) |
| *SizePrior* | 0.003 | * | (0.002) | 0.003 | | (0.002) |
| *%Titled* | 1.941 | *** | (0.713) | -0.024 | | (0.344) |
| *Adults* | 0.214 | | (0.172) | 0.091 | | (0.087) |
| *ValueAssets* | -0.001 | | (0.005) | -0.155 | | (0.110) |
| *AniW* | -0.028 | | (0.024) | -0.033 | | (0.028) |
| *Credit* | 0.742 | | (0.569) | 0.369 | | (0.313) |
| *Age* | 0.012 | | (0.021) | 0.035 | *** | (0.010) |
| *Edu* | 0.136 | *** | (0.047) | 0.093 | *** | (0.035) |
| *Female* | 0.640 | | (0.609) | 0.486 | | (0.304) |
| *OffInc* | -0.425 | | (0.789) | 0.817 | ** | (0.387) |
| *NonLInc* | -3.040 | *** | (1.141) | 1.036 | * | (0.608) |
| *Constant* | -6.878 | | (1.689) | -5.135 | | (0.910) |
| No. of obs. | 1710 | | | 1710 | | |
| Pseudo R2 | 0.13 | | | 0.13 | | |
| Log pseudo-likelihood | -423.94 | | | -423.94 | | |

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

Table 4-8b. Multinomial logit regression results (owners' decisions between farming, selling, renting under fixed-rent or under shared-rental contracts)

| Variables | Sell/ Farm | | | Fixed-rent/ Farm | | | Shared-rent/ Farm | | |
|---|---|---|---|---|---|---|---|---|---|
| | Coeff. | | Robust SE | Coeff. | | Robust SE | Coeff. | | Robust SE |
| *Coast* | -1.555 | * | (0.875) | 0.468 | | (0.564) | -37.685 | *** | (0.272) |
| *NonUrban* | -0.555 | | (0.669) | -1.242 | *** | 0.464) | -0.313 | | (0.506) |
| *Agcon* | 0.153 | | (0.539) | 0.249 | | (0.427) | -1.127 | ** | (0.545) |
| *SizePrior* | 0.003 | * | (0.002) | 0.004 | * | (0.002) | -0.001 | | (0.003) |
| *%Titled* | 1.948 | *** | (0.713) | -0.461 | | (0.541) | 0.521 | | (0.431) |
| *Adults* | 0.214 | | (0.173) | 0.142 | | (0.146) | 0.065 | | (0.103) |
| *ValueAssets* | -0.001 | | (0.005) | -0.132 | | (0.115) | -0.170 | | (0.181) |
| *AniW* | -0.028 | | (0.025) | -0.164 | * | (0.096) | -0.015 | | (0.018) |
| *Credit* | 0.743 | | (0.570) | 0.201 | | (0.479) | 0.460 | | (0.405) |
| *Age* | 0.012 | | (0.021) | 0.030 | * | (0.016) | 0.039 | *** | (0.012) |
| *Edu* | 0.138 | *** | (0.047) | 0.074 | | (0.050) | 0.115 | *** | (0.044) |
| *Female* | 0.640 | | (0.608) | 0.857 | ** | (0.425) | 0.210 | | (0.396) |
| *OffInc* | -0.430 | | (0.789) | 0.769 | | (0.540) | 0.699 | | (0.531) |
| *NonLInc* | -3.035 | *** | (1.140) | 0.462 | | (1.057) | 1.325 | * | (0.697) |
| *Constant* | -6.907 | | (1.691) | -5.443 | | (1.411) | -6.385 | | (1.162) |
| No. of obs. | 1710 | | | 1710 | | | 1710 | | |
| Pseudo R2 | 0.17 | | | 0.17 | | | 0.17 | | |
| Log pseudo-likelihood | -459.62 | | | -459.62 | | | -459.62 | | |

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

Table 4-9. Censored Tobit regressions (amount of land rented-out and sold)

| Variables | Amount sold | | | Amount rented-out | | |
|---|---|---|---|---|---|---|
| | Coefficient | | SE | Coefficient | | SE |
| *Coast* | -13.041 | | (10.445) | -0.439 | | (2.437) |
| *NonUrban* | -12.688 | | (9.144) | -9.609 | *** | (2.620) |
| *Agcon* | -1.574 | | (7.919) | -2.004 | | (2.224) |
| *SizePrior* | 0.058 | | (0.037) | 0.016 | | (0.016) |
| *%Titled* | 19.276 | * | (10.194) | 1.453 | | (2.041) |
| *Adults* | 2.187 | | (2.085) | 0.340 | | (0.623) |
| *ValueAssets* | -0.002 | | (0.115) | -0.793 | | (0.498) |
| *AniW* | -0.248 | | (0.381) | -0.087 | | (0.159) |
| *Credit* | 4.415 | | (7.555) | 0.722 | | (2.349) |
| *Age* | -0.006 | | (0.251) | 0.153 | ** | (0.066) |
| *Edu* | 2.127 | ** | (0.879) | 0.589 | ** | (0.264) |
| *Female* | 14.263 | | (8.757) | 4.889 | ** | (2.295) |
| *OffInc* | -8.184 | | (9.045) | 3.476 | | (3.026) |
| *NonLInc* | -53.473 | | (33.073) | 5.413 | | (4.585) |
| *Constant* | -95.005 | | (26.138) | -33.930 | | (6.936) |
| No. of observations | 1710 | | | 1710 | | |
| Uncensored obs. | 25 | | | 80 | | |
| Pseudo R2 | 0.08 | | | 0.06 | | |
| Log likelihood | -201.01 | | | -516.17 | | |

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

Table 4-10. Logit for probability of purchase and censored Tobit for amount of land bought

| Variables | Purchased | | | Amount purchased | | |
|---|---|---|---|---|---|---|
| | Coefficient | | Robust SE | Coefficient | | SE |
| *Coast* | -1.876 | ** | (0.727) | -4.287 | | (5.378) |
| *NonUrban* | -0.763 | | (0.731) | -1.305 | | (5.720) |
| *Agcon* | 0.148 | | (0.473) | -1.244 | | (4.141) |
| *SizePrior* | -0.178 | * | (0.103) | -0.659 | | (0.477) |
| *Adults* | 0.172 | | (0.157) | 1.012 | | (1.275) |
| *ValueAssets* | 0.008 | * | (0.005) | 0.034 | | (0.084) |
| *AniW* | 0.063 | *** | (0.020) | 0.398 | | (0.290) |
| *Credit* | 1.261 | *** | (0.422) | 9.604 | ** | (3.963) |
| *Age* | -0.050 | *** | (0.017) | -0.355 | ** | (0.160) |
| *Edu* | 0.056 | | (0.058) | 0.874 | | (0.487) |
| *Female* | -0.238 | | (0.626) | -2.714 | | (5.857) |
| *OffInc* | -0.121 | | (0.701) | -0.257 | | (5.680) |
| *NonLInc* | 0.673 | | (1.129) | 10.416 | | (9.373) |
| *Tenant* | 0.909 | * | (0.487) | 5.688 | | (3.921) |
| *Constant* | -2.453 | | (1.414) | -38.661 | | (12.674) |
| No. of observations | 1710 | | | 1710 | | |
| Uncensored obs. | | | | 33 | | |
| Pseudo R2 | 0.21 | | | 0.08 | | |
| Log pseudo-likelihood | -108.28 | | | -239.77 | | |

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

Table 4-11. Logit for probability of renting-in and censored Tobit for amount of land rented

| Variables | Rented-in | | | Amount rented-in | | |
|---|---|---|---|---|---|---|
| | Coefficient | | Robust SE | Coefficient | | SE |
| *Coast* | 0.132 | | (0.167) | 0.069 | | (0.519) |
| *NonUrban* | 0.172 | | (0.224) | -0.393 | | (0.701) |
| *Agcon* | 0.346 | ** | (0.145) | 0.597 | | (0.466) |
| *SizeOwned* | -0.196 | *** | (0.054) | -0.215 | *** | (0.040) |
| *Adults* | 0.119 | ** | (0.047) | 0.522 | *** | (0.138) |
| *ValueAssets* | 0.005 | | (0.003) | 0.021 | * | (0.011) |
| *AniW* | 0.034 | ** | (0.014) | 0.082 | ** | (0.041) |
| *Credit* | 0.726 | *** | (0.167) | 2.091 | *** | (0.503) |
| *Age* | -0.034 | *** | (0.005) | -0.092 | *** | (0.015) |
| *Edu* | -0.063 | *** | (0.022) | -0.163 | ** | (0.065) |
| *Female* | -0.461 | ** | (0.212) | -1.203 | ** | (0.608) |
| *OffInc* | -0.220 | | (0.218) | -1.122 | * | (0.634) |
| *NonLInc* | -0.179 | | (0.379) | -0.221 | | (1.149) |
| *Constant* | 0.585 | | (0.454) | -0.434 | | (1.341) |
| No. of observations | 1918 | | | 1918 | | |
| Uncensored obs. | | | | 494 | | |
| Pseudo R2 | 0.13 | | | 0.03 | | |
| Log pseudo-likelihood | -976.74 | | | -2124.91 | | |

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

Table 4-12. Multinomial logit for probability of renting-in

| Variables | Fixed-rent tenancy/Nothing | | | Shared-rent tenancy/Nothing | | |
|---|---|---|---|---|---|---|
| | Coefficient | | Robust SE | Coefficient | | Robust SE |
| *Coast* | 1.374 | *** | (0.268) | -0.500 | ** | (0.200) |
| *NonUrban* | 0.109 | | (0.350) | 0.224 | | (0.268) |
| *Agcon* | 0.590 | ** | (0.255) | 0.229 | | (0.161) |
| *SizeOwned* | -0.122 | ** | (0.060) | -0.275 | *** | (0.078) |
| *Adults* | 0.188 | ** | (0.081) | 0.086 | * | (0.051) |
| *ValueAssets* | 0.001 | | (0.004) | 0.008 | * | (0.004) |
| *AniW* | 0.037 | ** | (0.017) | 0.035 | * | (0.019) |
| *Credit* | 0.859 | *** | (0.304) | 0.688 | *** | (0.176) |
| *Age* | -0.032 | *** | (0.009) | -0.035 | *** | (0.005) |
| *Edu* | -0.013 | | (0.035) | -0.087 | *** | (0.025) |
| *Female* | -0.475 | | (0.407) | -0.516 | ** | (0.242) |
| *OffInc* | -0.101 | | (0.367) | -0.298 | | (0.257) |
| *NonLInc* | -0.256 | | (0.626) | -0.235 | | (0.452) |
| *Constant* | -2.126 | | (0.755) | 0.832 | | (0.542) |
| No. of observations | 1918 | | | 1918 | | |
| Pseudo R2 | 0.14 | | | 0.14 | | |
| Log pseudo-likelihood | -1226.01 | | | -1226.01 | | |

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

# CHAPTER 5
# CONCLUSIONS

The three essays presented here offered an economic analysis of agricultural land access at the household level and its relationship with rural markets and poverty in Ecuador. The severe inequality in land ownership and access has consequences for land and labor productivity and for access to credit, modern technologies and land markets. Land inequality has generated distortions in the access to agricultural markets over time, which have become institutionalized. Thus, the effects of land inequality on poverty are augmented by imperfections in those markets. The main findings of our study are summarized as follows:

1. Given the abundant labor availability of land-poor households, conditions of unemployment, incomplete credit markets, and segmented land markets cause small farms (less than 5 ha.) and especially *minifundios* (less than 1 ha.) to be more productive per unit of land but less productive per unit of labor than larger farms. Ecuador conforms to the traditional findings for developing countries, many times emphasized in the literature.

2. Land reservation prices per hectare decrease with the land to labor endowment ratio, which may explain why small farmers tend to be more active on the demand side of land markets than other farmers. However, similar to the findings of Carter and Salgado (2001), constraints in the credit market reduce and even overcome the advantage of poor farmers with respect to land reservation prices. As a consequence, the demand for land by the rural poor is better satisfied in the rental market. This is suggested by the result that the mean amount of land rented by households with less than 5 ha. is larger than the mean purchased, and by the finding that lack of credit limits the incidence and amount of land purchased more severely than it does the incidence and amount of land rented in. This supports the argument of Carter and Salgado (2001) that the effect of credit constraints in the demand for land in the rental markets would be magnified in the case of the land sales market.

3. For agricultural households, the effect of being able to access one more unit of land is such that it would improve the probability of credit access and the amount of credit obtained. More land would also allow for a more efficient labor allocation and increased labor productivity. Depending on endowments and output prices faced by the household, among other factors, one more unit of land would likely increase agricultural profits leading to higher household income. In addition, improved credit access would increase land reservation prices and the ability to purchase land. More credit would also help farmers acquire more and better intermediate assets, which would reinforce the process described above.

4. Contrary to the findings of Deininger et al. (2003), there was some indication that large landowners were willing to offer land in the land markets, reflected in the positive effect of farm size on the likelihood to sell and rent out land under fixed-rental contracts. However, that effect was not nearly as strong as the demand for land by small farmers (i.e., the negative effect of farm size on the likelihood to purchase and rent in land). In addition, 56% of the land sales and 71% of the land rentals (lessors) were by small farmers, which show that in general, these farmers were the most active in both sides of the land sales and rental markets.

5. Given the difficulties that prevent desired land transfers from large landowners to the rural poor –such as subdivision costs and a restricted supply of credit- it seems improbable that the market be able to achieve an optimal distribution of landownership without any assistance from the government.

6. Because of the severe land inequality in Ecuador and the distortions this has generated over time, the results regarding the estimated effects of one more unit of land mentioned in conclusion (3) represent the existing differences among farms of different sizes. To represent the potential of increased land access for rural development such an increase must be accompanied by better access to services so as to increase the competitiveness of the rural poor. In other words, since unequal land access and imperfections in the credit, labor and land markets form a pervasive synergy, a governmental policy oriented to increase land access for the rural poor would need to be complemented by other market reforms and by the provision of technical assistance.

7. Female headed households were more likely to offer land in the rental market (under fixed rental contracts) and less likely to demand land as tenants compared to households headed by men. This result reflects the lower competitiveness of women in agricultural production, which conforms to Deere and León (2001)'s claim of the disadvantages usually faced by women when trying to access credit, technical assistance or produce markets. Still, female headed households were not significantly more likely to participate in the land market as sellers than male headed households, nor were they significantly less likely to participate as land buyers. This supports Deere and León (2001)'s analysis since it reflects the importance of landownership for women, which may go beyond just obtaining agricultural profits: Landownership provides women with increased bargaining power in the household and the community, food security for their children and constitutes an asset which they can rent so as to generate income for the household. Also, the analysis showed that female headed households acquired land through the market in rates comparable to those of male headed households, a result that, as already noted by Deere and León (2003), makes Ecuador different from the rest of Latin American countries.

8. The value of animal stocks and the share of non-labor income are important variables in the determination of participation in the land markets which have not been considered in previous studies. The role of animal stocks as both work animals and a form of financial security for poor rural households is reflected in that they increase the likelihoods of purchasing and renting in land, as well as the amount of land rented in. They also decrease the likelihood of renting out land under fixed-rental contracts. Similar to the

findings for female headed households, those households with larger shares of non-labor income, which tend to be poor rural households, are less likely to sell their land but more likely to rent out (in this case under shared-rental contracts). This again suggests both the importance of land as an asset that can be rented and the lower competitiveness of this type of households. In any case, funds from remittances and governmental or non-governmental transfers help the rural poor to make up for immediate cash needs without resorting to selling their land.

9. Land titles increase the amount of institutional credit obtained but only for households who are able to access formal credit. They also increase the likelihood and amount of land sales. Unlike the findings of Feder and Feeney (1993), lack of land titles did not effectively discourage investment in land and did not cause land values to be smaller than for households with titled land. Also, contrary to the findings of Deininger et al. (2003) and Masterson (2005), land titles did not stimulate the supply of land in the land rental market, which suggests that the low level of development of the rental market may be due to the titles not being properly registered, or to the lack of knowledge about the relevant legislation as to the proper ways in which a fixed-rental contract should be carried out in order to avoid losing the land to the tenant, and/or to the deficiency of formal enforcement of property rights in Ecuador.

10. Conforming to Sadoulet et al. (2001), Binswanger et al. (1995) and Deininger et al. (2003) we found that the importance of the land rental market is that it provides the rural poor with an alternative to landownership, and the possibility that it will play a ladder toward landownership. In addition, sharecropping was found to be especially common among the land poor (less than 5 ha.), not only on the demand but also on the supply side of the market, with 64% of the supply and 81% of the demand cases being in the form of sharecropping. This suggests that sharecropping may be more a type of productive partnership rather than a precarious work relationship, which is emphasized by the fact that, given land market segmentation, rental relations are mainly among family, friends or in general, members of the same class. More research is required, however, as to the specific characteristics of sharecropping arrangements in Ecuador in order to confirm this proposition. This result also suggests the need for production support by small owners so that they are able to work the land directly if they so wish.

**Policy recommendations:** My results suggest that liberalization and stimulation of land rental markets are among the most urgent and important institutional changes that should take place in Ecuador so as to benefit the rural poor. This would entail the elimination of restrictions on sharecropping in the land legislation and the reduction of bureaucratic steps that cause high transaction costs for individuals wishing to rent land. More importantly, such reform would require the effective protection of property rights so as to ensure landowners of their rights to

land rented out. This calls for a stronger judicial system and the creation of effective mechanisms of conflict resolution (Barham et al., 2004).

Also, the general supply of credit (i.e., credit not only for agricultural purposes but also, non-agricultural), the most important stimulant of production and demand for land, needs to be increased in the rural sector, especially in communities where credit markets are missing. An innovative strategy such as the creation of credit bureaus which would turn information on borrower reputation public (Barham et al., 2004) may help overcome asymmetric information limitations faced by formal credit institutions. In addition, increased provision of technical assistance by the government is a crucial complementary policy given the traditional characteristics of small farmer agriculture and hence their lack of knowledge of modern, more productive technologies.

Results from this study provide evidence of the conditions sustaining rural poverty in one more country of the developing world. Our conclusions conform to many of the findings for other developing countries and hence add to the plea for sound institutional changes in the rural sector, which governments should promote. The need for improved data collection by governmental institutions must also be emphasized. For example, including survey questions aimed to gather data on who the principal agriculturalist in the household is; asset ownership by gender; the titling status of land that is sold and purchased; who in the household rented or sold land, and if possible, follow up surveys with the same sample of farmers over time (i.e., panel data) would be improvements that would facilitate and make more accurate the analysis of agricultural development.

APPENDIX
PRIMARY ACTIVITY OF FEMALE HOUSEHOLD HEADS

Table A-1. Primary activity of female household heads by farm size

| | Total | | Minifundio | | Small | | Medium | | Large | |
|---|---|---|---|---|---|---|---|---|---|---|
| | # | % | # | % | # | % | # | % | # | % |
| Ag. self employed | 163 | 18.1% | 80 | 35.2% | 57 | 15.7% | 18 | 7.1% | 8 | 14.3% |
| Ag. worker | 34 | 9.1% | 27 | 14.4% | 5 | 3.4% | 1 | 3.1% | 1 | 16.7% |
| Non-ag. self employed | 53 | 20.3% | 37 | 25.0% | 8 | 11.9% | 7 | 18.9% | 1 | 11.1% |
| Non-ag. worker | 18 | 5.5% | 16 | 8.0% | 1 | 1.0% | 1 | 3.4% | 0 | 0.0% |
| Not economically active or unemployed | 31 | 53.4% | 14 | 58.3% | 8 | 44.4% | 7 | 58.3% | 2 | 50.0% |
| Total | 299 | 15.6% | 174 | 22.1% | 79 | 11.4% | 34 | 9.4% | 12 | 15.8% |

LIST OF REFERENCES


Agresti, A. (1996). *An introduction to categorical data analysis*. New York: Wiley.

Alvarez, Silvia (1999). *De Huancavilcas a Comuneros*. Guayaquil, Ecuador: ESPOL Press.

Andersen, T., & Malchow-Moller, N. (2006). Strategic interaction in undeveloped credit markets. *Journal of Development Economics, 80*, 275-298.

Bardhan, P., & Udry, C. (1999). *Development microeconomics*. New York: Oxford University Press.

Berry, R.A., & Cline, W. (1979). *Agrarian structure and productivity in developing countries*. Baltimore: The Johns Hopkins University Press.

Binswanger, H., Deininger, K., & Feder, G. (1993). Agricultural land relations in the developing world. *American Journal of Agricultural Economics 75*, 1242-1248.

Binswanger, H., Deininger, K., & Feder, G. (1995). Power, distortions, revolt and reform in agricultural land relations. In J. Behrman, & T.N. Srinivasan (Eds.), *Handbook of Development Economics, Volume 3B* (pp: 2659-2772). Amsterdam: North Holland.

Boucher, S., Barham, B., & Carter, M. (2005). The impact of 'market-friendly' reforms on credit and land markets in Honduras and Nicaragua. *World Development, 33*(1), 107–128.

Camacho, G. (2005). Migración, género y empleo en el Ecuador. *Informe Organización Internacional del Trabajo OIT*, Septiembre 2005, Quito.

Carter, M., & Salgado, R. 2001. Land market liberalization and the agrarian question in Latin America. In A. de Janvry, G. Gordillo, J. Platteau, & E. Sadoulet (Eds.), *Access to land, rural poverty and public action* (pp. 246-278). New York: Oxford University Press.

Carter, M., & Zegarra, E. (1995). Reshaping class competitiveness and the trajectory of agrarian growth with well sequenced policy reform. Working Paper, Department of Agricultural Economics, University of Wisconsin, Madison.

Carter, M., & Zegarra, E. 2000. Land markets and the persistence of rural poverty: Post-liberalization policy options. In R. López, & A. Valdés (Eds.), *Rural poverty in Latin America* (pp. 65-85). New York: St. Martin's Press, Llc.

Castillo, M.J., Useche, P., & Moss, C.B. (2007). Missing agricultural price data: an application of mixed estimation. Working Paper, Food and Resource Economics Department, University of Florida, Gainesville.

Chiriboga, M., & Rodríguez, L. (1998). *El sector agropecuario Ecuatoriano: tendencias y desafíos*. CONAM, Ecuador.

Currie, J.M. (1981). *The economic theory of agricultural land tenure*. New York: Cambridge University Press.

De Ferranti, D., Perry, G., Ferreira, F., & Walton, M. (2003). *Inequality in Latin America and the Caribbean: breaking with history?* The World Bank, Washington D.C.

De Janvry, A., Platteau, J., Gordillo, G., & Sadoulet, E. (2001). Access to land and land policy reforms. In A. de Janvry, G. Gordillo, J. Platteau, & E. Sadoulet (Eds.), *Access to land, rural poverty and public action* (pp. 1-26). New York: Oxford University Press.

Deere, C.D., & León, M. (2001). *Empowering women: Land and property rights in Latin America*. Pittsburgh, PA: University of Pittsburgh Press.

Deere, C.D., & León, M. (2003). The Gender Asset Gap: Land in Latin America. *World Development, 31*(6), 925-947.

Deininger, K., & Binswanger, H. (2001). Evolution of the World Bank's Land Policy. In A. de Janvry, G. Gordillo, J. Platteau, & E. Sadoulet (Eds.), *Access to land, rural poverty and public action* (pp. 406-440). New York: Oxford University Press.

Deininger, K., & Olinto, P. (2000). Asset distribution, inequality, and growth. *World Bank Policy Research Paper 2375*. The World Bank, Washington, D.C.

Deininger, K., Zegarra, E., & Lavandez, I. (2003). Determinants and impacts of rural land market activity: Evidence from Nicaragua. *World Development, 31*(8), 1385-1403.

Economic Commission for Latin America and the Caribbean (ECLAC). (2005). *Statistical yearbook for Latin America and the Caribbean*. United Nations Publication, Santiago, Chile.

Espinel, R. (2002). Formación de sistemas financieros rurales en la crisis bancaria ecuatoriana. *Ecuador Debate, 56*, 20-27.

FAO – COTECA. (1995). Mercado de Tierras en el Ecuador: Estudio Integrado Regiones Litoral y Sierra. FAO, Roma.

FAO. (2002). Arrendamiento de tierras en América Latina: una alternativa de acceso a la tierra para los pobres rurales? *FAO Investment Centre Occasional Paper Series, 13*.

FAO. (2004). *FAO Statistical country profile*. FAO Statistics Division <http://www.fao.org/es/ess/yearbook/vol_1_2/pdf/Ecuador.pdf>.

FLACSO & UNFPA (2006). *Ecuador: Las cifras de la migración internacional*. Quito, Ecuador.

Feder, G., & Feeney, D. (1993). The theory of land tenure and property rights. In K. Hoff, A. Braverman, & J. Stiglitz (Eds.), *The economics of rural organization: theory, practice, and policy* (pp. 240-258)). New York: Oxford University Press.

Feder, G., Oncahn, T., Chalamwong, Y., & Hongladarom, C. (1988). *Land policies and farm productivity in Thailand*. Baltimore: The Johns Hopkins University Press.

Finan, F., E. Sadoulet and A. de Janvry. 2005. "Measuring the poverty reduction potential of land in rural Mexico," *Journal of Development Economics*, Vol. 77, pp. 27-51.

Girkinger, C., & Boucher, S. (2005). Credit Constraints and Productivity in Peruvian Agriculture. Working Paper, Department of Agricultural and Resource Economics, University of California, Davis.

Gould, K. (2001). Land titling on an agricultural frontier, Petén, Guatemala. M.S. thesis, University of Florida, Gainesville, Department of Forest Resources and Conservation.

Hayami, Y., & Otsuka, K. (1993). *The economics of contract choice: an agrarian perspective*. New Cork: Oxford University Press.

Instituto Nacional de Estadisticas y Censos (INEC), Ecuador. <http://www.inec.gov.ec>.

Jordán, F. (2003). Reforma Agraria en Ecuador. In *Paper presented at Seminario Internacional: "Resultados y Perspectivas de las Reformas Agrarias y los Movimientos Indígenas y Campesinos en América Latina,"* Universidad Mayor de San Andrés, Julio 2003, La Paz.

Lambert, V., & Stanfield, D. (1990). Case studies of rural land markets in Ecuador. Working Paper, The University of Wisconsin, Land Tenure Center, Madison, WI, and the Centro Andino de Acción Popular, Quito, Ecuador.

Lehman, D. (1986). Sharecropping and the capitalist transition in agriculture. *Journal of Development Economics, 23*, 333-354.

Lopez, R., & Valdes, A. (2000). Fighting rural poverty in Latin America: New evidence of the effects of education, demographics and access to land. *Economic Development and Cultural Change49*(1), 197-211.

Marcours, K., de Janvry, A., & Sadoulet, E. (2004). Insecurity of property rights and matching in the tenancy market. *CUDARE* Working Paper 992, Department of Agricultural and Resource Economics, University of California, Berkeley.

Masterson, T. (2005). Land markets, female land rights and agricultural productivity in Paraguayan agriculture. Ph.D. thesis, University of Massachusetts, Amherst, Department of Economics.

Migot-Adholla, S., Hazell, P., Blarel, B., & Place, F. (1993). Indigenous land rights systems in Sub-Saharan Africa: A constraint on productivity? In K. Hoff, A. Braverman, & J. Stiglitz (Eds.), *The economics of rural organization: Theory, practice and policy* (pp. 269-291). New York: Oxford University Press.

Mishra, A., Moss, C.B., & Erickson, K. (2004). Valuing farmland with multiple quasi-fixed inputs. *Applied Economics, 36*, 1669-1675.

Moss, C.B., Schmitz, A., & Livanis, G. (2008). The effect of increased energy prices on agriculture: a differential supply approach. Working Paper, Food and Resource Economics Department, University of Florida, Gainesville.

Nieto, C. (2004). El acceso legal a la tierra y el desarrollo de las comunidades indígenas y afroecuatorianas: la experiencia del PRODEPINE en el Ecuador. In P. Groppo (Ed.), *Land reform: Land settlement and cooperatives* (pp. 96-109). Rome: FAO.

Otáñez, G., Maldonado, J., Rentaría, F., & Camacho, E. (2001). *Ecuador: breve análisis de los resultados de las principales variables del Censo Nacional Agropecuario 2000*. Cámara Nacional de Acuacultura y Sistema Estadístico Agropecuario Nacional, Ecuador.

Sadoulet, E., Murgai, R., & de Janvry, A. (2001). Access to land via land rental markets. In A. de Janvry, G. Gordillo, J. Platteau, & E. Sadoulet (Eds.), *Access to land, rural poverty and public action* (pp. 196-229). New York: Oxford University Press.

Santos-Ditto, J. (1999). *Derecho Agroambiental en América Latina*. Guayaquil, Ecuador: Editorial de la Universidad de Guayaquil.

Schultz, T. (1945). *Agriculture in an unstable economy*. New York: McGraw-Hill Book Company, Inc.

Singh, I., Squire, L., & Strauss, J. (1986). Methodological issues. In I. Singh, L. Squire, & J. Strauss (Eds.), *Agricultural Household Models: extensions, applications and policy* (pp. 48-91). Baltimore: Jon Hopkins University Press.

Terrell, D. (1996). Incorporating monotonicity and concavity conditions in flexible functional forms. *Journal of Applied Econometrics, 11*(2), 179-194.

World Bank. 2004. *Ecuador poverty assessment*. World Bank, Report No. 27061-EC.

Zimmerman, F., & Carter, M. (2003). Asset smoothing, consumption smoothing and the reproduction for inequality under risk and subsistence constraints. *Journal of Development Economics, 71*(2), 233-260.

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