



Determinants and Impacts of Rural Land Market Activity: Evidence from Nicaragua

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Summary. — Use of data from Nicaragua to examine the performance of land rental and sales markets during 1995–98 which coincide with the implementation of major macroeconomic and sectoral reforms leads to three main conclusions. First, even though the data point toward an inverse farm-size productivity relationship and large differences in land productivity between large and small producers, land markets have not led to an equalization of returns among the groups considered. Second, both in 1995 and in 1998, land sales markets have contributed to land concentration, suggesting that credit market imperfections impeded demand in land sales markets. Third, the policy reforms undertaken after 1995 have led to a structural shift in the performance of the land rental market; instead of transferring land to large owners, as it did in 1995, the land market now moves land from large to small producers. The quantities involved however, remain limited. We conclude that, if it is to contribute to equity and efficiency, liberalization of land sales markets has to be complemented by measures to reduce the attractiveness of speculative land accumulation. Furthermore, measures to reduce the transaction costs of land rental (e.g., titling) and to increase effective demand from small producers (e.g., technical assistance and credit) will be needed.

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1. INTRODUCTION

Increasing poor people's access to economic opportunities and assets is a major concern for policy-makers and those interested in development alike. In developing countries with a predominantly rural and agrarian structure, this generally involves access to land as a key factor of production and asset. It is thus not surprising to find that measures to improve the functioning of land markets have figured high on the agenda of economic liberalization in Eastern Europe, Latin America, and to a lesser degree Asia and Africa. Given the long and often violent history of conflict over land (Brockett, 1998) and the continuing importance

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of the primary sector in much of Central America, providing those who need land and are willing and able to make productive use of this factor with the opportunity to do so is of broader social importance.

While there is agreement about the need to increase land access to improve households' productive capacity and their welfare, there is less consensus on policies required to accomplish this goal, in particular the role of markets in doing so. Governments and policy advisers who have become disillusioned with the unsatisfactory results of heavy state intervention have often come to favor a more market-oriented approach. On the other hand nongovernmental organizations (NGOs) and advocacy groups generally claim that the operation of land markets systematically disenfranchises the poor and demands heavier state intervention to either support or substitute for markets. In this debate it is often overlooked that markets are not an abstract entity that functions in a vacuum but that the ability to make use of markets depends on pre-existing endowments, access to information, and technology, all of which may well result in systematic imperfections (Carter & Barham, 1996; Barham, Carter, & Sigelko, 1995). In addition to these factors, the regulatory and policy framework within which markets are embedded is instrumental in determining the nature of the outcomes. The extent to which public goods are provided, the broader regulatory environment, and imperfections in other markets all will affect the extent to which liberalization of land markets will lead to outcomes that contribute to both efficiency and equity as would be predicted in an ideal and undistorted environment (Binswanger, Deininger, & Feder, 1995).

Thus, the extent to which markets can help achieve broader goals of equity and efficiency, or the type of government intervention needed to ensure that these goals are maximized, is very much an empirical question. As the answer to this question is at least in part determined by the specific conditions prevailing in any given context, this calls for empirical research to characterize the functioning of land markets and highlight their relationship to specific government policies. In addition to putting the discussion on more firm empirical ground, doing so could also help to shift attention from stereotypes toward identification of specific policy actions that would be required to either complement markets or help them function better. The broad movement toward greater market liberalization

in Latin America during the last decade provides interesting material to study these issues.

In this paper, we use the case of Nicaragua, a country which, in addition to having had a long history of conflicts over land access, has recently undertaken far-reaching reforms to liberalize the rural economy and to improve the functioning of land and other factor markets. Based on a description of the main land policy issues and key reforms undertaken, we assess the extent to which the policy changes have achieved their objectives, how the functioning of land markets has changed over time, what the determinants of agricultural profitability are, and what this means for the functioning of land markets and their impact on productivity as well as equity. In doing so we hope to provide a basis for a more impartial assessment of the potential and possible shortcomings of land market liberalization that can input into the ongoing policy discussion.

The structure of the paper is as follows: Section 2 describes the background and recent policy changes, the structure of the rural sector, and the operational and ownership distribution of land. Section 3 assesses the functioning of land sales and rental markets separately, using both nonparametric and parametric methods. The goal is not only to describe but also to identify policy measures that can be used to improve the functioning of such markets. Section 4 provides a summary of the impact of land market operation on agricultural productivity as well as household welfare. Section 5 concludes with policy recommendations.

2. AGRARIAN POLICY AND LAND OWNERSHIP STRUCTURE IN NICARAGUA

Due to land tenure problems that are deeply rooted in the country's history, Nicaragua is characterized by a very unequal distribution of land ownership and high levels of tenure insecurity. In this section we describe not only the sources of these problems but also key elements of the strategy to address them as implicit in recent policy changes in the area of prices and incentives, tenure security and operation of land markets, and the provision of public goods such as technology and credit infrastructure. We use this to provide a profile of rural producers in Nicaragua.

(a) *Context and historical background*

With a 1998 per capita GNP of US\$370, Nicaragua is the poorest country on the American continent. Poverty is particularly prevalent in rural areas—over 75% of the rural population live in poverty; more than one third in extreme poverty. Lack of access to land and human as well as physical capital have been identified as key determinants of poverty (Merlet & Pommier, 2000). As rural residents derive about two-thirds of their income from agricultural production, improvements in their ability to access land, make productive use of it, and undertake labor-intensive land-attached investments, are likely to be translated into immediate welfare and nutritional benefits.

Conflicts over land, which have figured prominently in the country's history, have a decisive impact on the current distribution of land and other productive assets. In the late 19th century, the country experienced a prolonged agro-export boom in coffee which was followed by livestock and cotton booms during the Somoza period (1936–79). These booms were associated with appropriation of frontier land by politically well-connected individuals, increasing inequality in the land ownership distribution, and lack of access to opportunities for the large majority of the rural poor (Brockett, 1998). The Sandinista government which came to power following the 1979 revolution aimed to reverse this situation by implementing a land reform program, together with social initiatives aimed at improving the country's human capital base (Pelupessy, 2000). While the impact of these measures on productivity was limited, due to a continuing civil war and a centralized and collectivist production structure, there were lasting legal repercussions that came to affect land reform beneficiaries after the change of regime in 1990. The reason is that many of the properties that had been given out by the government, both in rural and in urban areas, had not been properly transferred into the property of the state. Estimates suggest that about one-third of the country's area may be affected.¹ This implies that, even if they have access to land, beneficiaries of earlier land reform may not be able to utilize fully this asset because the land cannot be used as collateral or, in worse cases, even be forced to progressively sell off parts of their land endowment in order to fend off conflicting claims (Baumeister, 1999). Given the magnitude of the problem, a significant effort will be

needed to settle these claims in a definitive manner, through a legal framework and subsequent issuance of certificates that would make properties immune against the sudden surfacing of restitution claims. In addition, unless attended to quickly, the insecurity of property rights could easily spread beyond the initial claims for restitution, posing a threat to the broader stability of property rights to land in the country. To deal with this legacy, the Government has made considerable efforts in the areas of land policy, the broader incentive framework, and the provision of public goods to rural dwellers. We briefly discuss each of these below.

In the area of land, the government has aimed to prevent the emergence of new land conflicts, resolve existing ones, and reduce insecurity of tenure for occupants. To accomplish this, a large-scale titling program was implemented with international support. During 1995–2001, this program awarded slightly more than 30,000 titles to occupants of land in the "reform sector," i.e., those who had received land during the Sandinista period. While, in terms of the number of titles awarded, this program is a clear success, there is some concern that the methodology used may have left out the poor or that the impact of the program was less than expected (Merlet & Pommier, 2000).² Moreover, the government's ability to act more decisively in the land sector was limited by political struggle, the urgent need to stabilize the economy and maintain budgetary discipline, the reward of land to de-mobilized combatants, and a shortage of funds to compensate former landowners.³ This was compounded by lack of the necessary land administration infrastructure (many of the registries have actually been destroyed in the past), and a legislation that neither assigns clear institutional responsibility for dealing with land restitution claims nor sets time limits within which such claims have to be dealt with. This has made it easy to lodge spurious claims for a variety of other reasons (e.g., to settle personal vendettas), led to a generalized reduction of tenure security even for those who were in legitimate possession of their lands,⁴ and created a fertile environment for land invasions. As a result, in many *departamentos* the area disputed is now considerably in excess of physical amount of land available.

In the area of rural finance and technical assistance, the state bank BANADES which had previously given out loans at preferential

interest rates, largely to big producers, was closed down in 1997 (Gobierno de Nicaragua, 1999). Available evidence points toward a contraction in the availability of rural credit, in that both the number of loans available to rural producers as well as the mean amount per loan decreased over 1995–98 (Davis, Calogero, & Sil, 1997). This suggests that plans to maintain the extensive branch network of BANADES in order to provide access to credit for small producers were less successful, implying that, following the reforms, small producers had to obtain working capital mainly from informal markets. The restructuring of credit was accompanied by measures to improve the quality of technical assistance to small farmers, partly by bringing in the private sector and increased cost recovery for the better off (Keynan, Olin, & Dinar, 1997).

As regards price and incentive policy, the Government has, in the context of macro-economic adjustment, made considerable progress towards the elimination of implicit and explicit protection to large farm crops and in particular subsidies to the livestock sector (Gobierno de Nicaragua, 1999). Again, if there is a negative relationship between farm size and productivity (Binswanger *et al.*, 1995) and if markets work well, elimination of subsidies as well as preferential credit access by large producers would be expected to reduce incentives for speculative acquisition of land and result in a shift from extensive land use towards more intensive cultivation.⁵ The extent to which this will actually occur is an empirical issue.

(b) *Data sources*

To explore the impact of policy reforms on welfare, productivity, and the functioning of rural factor markets in Nicaragua empirically, we rely on two surveys, both undertaken in 1998. One is the Living Standards Measurement Survey (LSMS) which was administered to a sample of about 4,300 households by the National Statistical Institute, with support from the World Bank. This is a typical multi-purpose household survey containing relatively detailed information on agricultural activities in addition to modules on education, health, employment, expenditure, time use, and use of other public services. The sample frame was the 1990 Population Census with rural and urban areas serving as two separate strata. Although this survey is representative of Nicaragua's population, household-based samples will not

provide an accurate representation of land area in situations where, as in the case of Nicaragua, the distribution of land is skewed. To obtain nationally representative information on physical area, we use a 1998–99 survey of agricultural producers that was carried out by the Ministry for Agriculture and Forestry (MAGFOR). This survey, which is based on an area-frame, the construction of which is described in detail elsewhere (Steiner, 1999), was administered to a sample of 2,000 agricultural producers. Although it contains limited information on socioeconomic characteristics, it allows us to make inferences about the totality of the land area under exploitation in all of the country's territory except the Atlantic Coast. Together with a very similar 1995 survey by MAGFOR on a slightly smaller number of households (Davis *et al.*, 1997), this enables us to establish a pooled sample covering 1995–99 which is used to describe the effectiveness of the changes in government policy and to make inferences regarding their impact.

(c) *Nicaragua's rural population and rural producers*

Table 1 illustrates general characteristics of the rural and urban subsamples from the household survey. One notes a marked gap in welfare between urban and rural households, with expenditure and income for the latter amounting to only about half of what is available to urban households. At the same time, we note that even rural households rely on a broad variety of income sources, as is documented in greater detail elsewhere (Corral & Reardon, 2001). Column 3 of Table 1 illustrates that, of the total income received in rural areas, only 51% comes from the agricultural sector, while 29% is derived from nonagricultural wages, 14% from nonagricultural self-employment, and 6% from remittances. The fact that the majority of income for those in the rural agricultural sector comes from wages (31% of the total) rather than self-employment (20% of the total) suggests that, possibly because of a skewed distribution, land ownership does not offer gainful self-employment opportunities to the majority of households in Nicaragua.

We distinguish four groups of rural dwellers, depending on the sector of employment (agriculture and nonagriculture) and the main source of income (wages and self-employment).⁶ The resulting figures highlight not only

Table 1. *Characteristics of the rural and urban population in Nicaragua, 1998*

	Nicaragua	Urban	Rural	Rural by "type"			
				Agriculture		Nonagriculture	
				Worker	Self-emp.	Worker	Self-emp.
<i>Expenditure and income</i>							
Per capita expenditure	8,257	10,656	5,073	4,271	5,115	5,174	6,156
Per capita expenditure (median)	5,226	6,919	3,691	3,307	3,506	4,452	5,026
Per capita income	8,762	11,857	4,653	2,757	4,044	6,654	5,596
<i>Income sources</i>							
Pct. from agricultural wages	16%	4%	31%	84%	4%	7%	1%
Pct. from agricultural self-employment	10%	2%	20%	4%	86%	1%	5%
Pct. from nonagricul- tural wages	45%	56%	29%	6%	1%	82%	9%
Pct. from nonagricul- tural self-employment	23%	29%	14%	1%	2%	5%	79%
Pct. from other sources (incl. remittances)	7%	8%	6%	5%	7%	6%	6%
<i>Characteristics of household head</i>							
Age	45.3	45.7	44.8	43.5	46.3	42.7	48.4
Male	72.1%	65.0%	81.6%	84.9%	93.4%	76.5%	73.6%
No formal education	32%	21%	46%	57%	52%	32%	41%
Illiterate	25%	15%	38%	48%	44%	25%	32%
Years of education	4.5	5.9	2.7	1.8	2.0	3.8	3.1
<i>Asset and land ownership</i>							
Total land owned (mzs)	6.0	2.9	10.1	6.5	33.7	3.4	5.6
Total assets owned in C\$ (median)	15,050	20,000	10,400	6,300	26,000	10,000	18,270
Value of nonagricultural assets in C\$ (median)	10,000	15,500	5,000	1,500	5,000	6,500	10,000
<i>Access to markets</i>							
Use of credit	17.8%	22.4%	11.6%	7.1%	11.2%	14.1%	15.8%
Access to technical assistance	4.1%	1.1%	8.0%	7.8%	13.5%	6.7%	5.7%
<i>Distribution of sample</i>							
No. of households (expanded)	774,997	442,209	332,788	56,231	113,288	90,026	73,243
Population share		57.1%	42.9%	16.9%	34.0%	27.1%	22.0%
Total population (expanded)	4,174,591						

Source: Own computation from 1998 LSMS and MAGFOR Survey.

that the rural population is almost equally split between the agricultural and the nonagricultural sector but also that agricultural workers account for 17% of rural households, agricultural self-employed for 34%, nonagricultural

workers for 27% and nonagricultural self-employed for 22% (columns 4–7 in Table 1).

Across the groups, especially between those employed in the agricultural and those in the nonagricultural sector, the most striking

difference is households' differential endowment with human as well as physical capital. As illustrated in the table, the head's educational achievement in agricultural workers' and self-employed households are with 1.8 and 2.0 years of schooling completed, significantly below those of workers and self-employed in rural nonagriculture (3.8 and 3.1 years, respectively) and the urban sector (5.9 years). This combines with the high levels of illiteracy in agriculture (48% among workers and 44% among the self-employed, as compared to 25% for Nicaragua overall and 15% in the urban sector). It is of interest to note that this difference appears to persist across generations—the highest educational level of any family member in households of agricultural workers (4.2) is still far from the 7.4 years for nonagricultural workers. The low levels of education among the farming population could point toward a process of selection whereby the least educated are left in the agricultural sector whereas the more able diversify out of agriculture.

At the same time, education is not the only asset that those in the agricultural sector seem to be lacking; descriptive evidence points to a very low level of physical endowments. In the case of nonagricultural assets, for example, what is owned by the median agricultural workers is less than one-tenth of the endowment of the median urban dweller and less than one-third of that of the median agricultural self-employed. This suggests that lack of human capital and other assets could constitute an important barrier to specialization in either off-farm employment or agriculture. As has been emphasized in the literature on poverty traps (e.g., Jalan & Ravallion, 1999), low physical and human capital could leave landless agricultural workers no alternative than to seek low-paid seasonal jobs which put them at the bottom of the earnings pyramid, something that is confirmed empirically for the case of Colombia (Deininger & Olinto, 2001). Whether better functioning markets for land could provide households with an opportunity to break out of their situation and, by climbing up the "agricultural ladder," gradually start accumulating assets, will require more detailed empirical analysis.

We complement the description of the overall population with a typology of rural producers, based on their main source of income (livestock, coffee, traditional maize and beans, others) and the size of the owned area (above and below 20 mzs for livestock and 5 mzs for

the remainder). This identifies eight types of producers, livestock producers 26% of producers and 65% of the area, coffee producers (4% of producers and 6.6% of the area), maize and beans farmers (42% of producers and 28% of the area), and diversified farmers (28% of producers and 10% of the area). Doing so confirms earlier results regarding low levels of human capital, as well as the reliance on a diverse range of income sources. Table 2 illustrates that 40% of agricultural producers' income is from outside the agricultural sector (21% from nonagricultural wages, 13% from self-employment and 6% from remittances). It appears that, similar to the importance of education for wage employment, higher levels of assets, either in the form of land or in the form of land-related improvements such as coffee, are a necessary pre-condition for rural producers to specialize and thus obtain higher levels of agricultural income.

Two additional elements emerging from descriptive data are the limited access to credit and the high level of inequality in the land ownership distribution. Quite surprisingly in view of the fact that the country underwent a revolution that aimed to widely redistribute land, the Gini coefficient of the land ownership distribution is estimated to be 0.86, due to presence of a number of extremely large holdings compared to a large number of small and marginal farms. This is similar to what is found in other Latin American countries and significantly above the values of Asian countries, such as Korea, Japan, and China that underwent a process of land redistribution and which generally have Gini coefficients of around 0.4. In terms of different groups' endowments, we note that large ranchers own a mean of almost 130 mzs, while small maize and bean producers own 1.2–1.3 mzs on average. The key question of interest is why this translates into differences in the intensity of factor use as well as partial productivity that could be ameliorated by land markets. Exploring the extent to which markets help to equalize the operational and ownership distribution of land will be the topic of the next two sections.

3. DETERMINANTS OF LAND ACCESS AND THE PRODUCTIVITY OF LAND USE

This section takes the descriptive analysis conducted above further by highlighting the

Table 2. *Characteristics of agricultural producers, 1998^a*

	Total	Livestock ranchers		Coffee growers		Maize and beans		Diversified farmers	
		Small	Large	Small	Large	Small	Large	Small	Large
<i>Expenditure</i>									
Per capita expenditure	4,951	5,487	9,176	4,653	13,208	3,907	4,319	4,970	7,287
Per capita expenditure (med.)	3,549	4,067	5,556	3,800	8,385	3,057	3,419	3,610	4,973
<i>Sources of income</i>									
% Agricultural wages	26%	22%	20%	19%	5%	34%	30%	19%	25%
% Agricultural self-employment	33%	33%	54%	66%	95%	28%	49%	30%	35%
% Nonagricultural wages	21%	22%	13%	3%	0%	21%	8%	27%	23%
% Nonagricultural self-employment	13%	14%	6%	8%	0%	12%	9%	17%	10%
% Other (incl. remittances)	6%	8%	7%	3%	0%	6%	5%	7%	7%
<i>Characteristics of the household head</i>									
Age	46.44	47.78	45.91	44.06	55.15	44.10	50.31	47.94	48.99
Male	89%	87%	99%	93%	100%	89%	88%	87%	95%
Years of education	2.24	2.15	3.88	2.40	3.57	1.99	1.06	2.64	2.34
No education	51.2%	52.2%	44.2%	43.7%	35.1%	53.1%	71.7%	45.1%	54.6%
Illiterate	41.8%	38.6%	33.7%	29.5%	24.1%	46.8%	55.8%	37.2%	43.0%
Years of education	2.24	2.15	3.88	2.40	3.57	1.99	1.06	2.64	2.34
<i>Asset and land ownership</i>									
Total land owned (mz)	21.2	16.6	299.2	7.4	142.0	2.8	60.3	3.6	60.5
Median of total assets owned	16,900	25,000	218,000	55,050	275,000	10,000	62,000	13,150	48,730
Value of nonagricultural assets	13,751	16,852	40,075	15,699	18,109	7,787	14,891	15,817	17,469
<i>Access to markets</i>									
Use of credit	11.2%	14.3%	14.7%	13.1%	36.2%	9.4%	9.5%	11.3%	5.0%
Access to technical assistance	14.6%	16.9%	30.3%	18.6%	8.0%	14.6%	13.3%	12.2%	6.5%
<i>Distribution of sample</i>									
No. of households (expanded)	212,464	48,748	6,205	7,030	1,483	81,437	8,001	48,159	11,401
Population share		22.9%	2.9%	3.3%	0.7%	38.3%	3.8%	22.7%	5.4%
Total area	9,102,311	1,659,829	4,254,059	171,090	427,174	606,561	1,075,048	173,549	735,001
		18.2%	46.7%	1.9%	4.7%	6.7%	11.8%	1.9%	8.1%

Source: Own computation from 1998 LSMS and MAGFOR Survey.

^a Total number of farmers includes land owners and people with borrowed/squatted land but excludes tenants. Percentage of area by type is based on MAGFOR Survey 1998 (Mercado de Tierras).

incidence of land titles among differently sized producers, by exploring productivity and market participation by producers in different size classes, and by estimating a pseudo-profit function to explore determinants of agricultural profitability. There are three main findings. First, insecure land tenure affects predominantly the poor. Second, despite considerable differences in marginal productivity of land, the extent to which markets lead to equalization of factor ratios is quite limited. Finally, while land ownership has a positive impact on agricultural production, there is clear evidence that larger operated area is associated with lower profits. This provides a justification for exploring the functioning of land markets more systematically.

(a) *Land titles and tenure security*

One of the preconditions for well-functioning land markets, both on the supply and the demand side, is the presence of secure and well-documented title to land (Alston, Mueller, & Libecap, 1999). Lack of a formal proof of land ownership is likely to reduce prices in the land sales market and to undermine supply of land to rental markets. At the same time, by reducing the ability to access formal credit, it would also affect demand in the land sales market by those who already own some land.⁷ Landowners in Nicaragua have a number of official and unofficial documents that imply different levels of legal tenure security. The only document which, by certifying the absence of competing claims to land, confers fully secure ownership is a registered title. Agrarian reform titles are of lower value not only because they come with a number of restrictions but, more importantly, because having an agrarian reform title does not necessarily imply that somebody else may not have a similar document to the same piece of land. Obviously, other documents, for example the widely available "titulo supletorio" which confirms possession but not ownership are of even lower legal value (Deininger & Chamorro, in press).

Table 3 illustrates patterns of land distribution in terms of area as well as the number of households as obtained from households' response to questions on their title status. In interpreting these figures, it is important to keep in mind that, in view of the tendency of survey respondents to overstate the extent of ownership security, the figures reported are likely to constitute a lower bound for the true extent of

land under insecure title.⁸ We find that almost 70% of Nicaragua's agricultural area, or about 7 mn mzs have, according to the information provided by survey respondents, registered title, while the remainder is distributed among land with agrarian reform title (9%), other documents confirming possession but not ownership (3%), and no document at all (11%). More importantly, it is poor and small producers who are disproportionately affected by insecure tenure or complete lack of formality. As illustrated in panel 2 of the Table 3, registered title and the security of tenure it conveys is available to only 43% of the households in the country.

Even though the area lacking any formal documentation appears, with 11%, to be relatively modest, the inequality of the land ownership distribution implies that the lack of formal documentation is disproportionately concentrated among the poor. The pervasive nature of tenure insecurity among the poor is illustrated by the fact that, with the exception of coffee producers,⁹ consistently more than half of Nicaragua's small producers (almost two-thirds of small maize and beans producers, 55% of small mixed farmers, and 50% of small livestock ranchers) report to lack formal proof of land ownership. This is likely to have important implications on those groups' ability to make investments, start enterprises, and participate in economic activity (de Soto, 2000). We also note that the number of households lacking title is estimated to be almost exactly 100,000. Even under the assumption that these cases do not pose greater difficulties than the ones that had been attended to in the past, providing title to these would require to more than triple past efforts which, over a period of about 6 years, have provided slightly more than 30,000 titles.

(b) *Descriptive evidence on partial productivity and land market participation*

To explore to what extent the large differences in land endowments translate into differential productive performance, we compute a measure of profits per unit area for all the producers in the sample by subtracting the cost of variable inputs from total output. Labor is valued at the local wage rate, to reflect true opportunity cost. Table 4 provides descriptive evidence in the aggregate and for the different groups of producers defined earlier. Although we would expect differences, the fact that the mean profit per manzana for large producers is

Table 3. *Prevalence of different categories of land title by producer type and region*

	Registered title	Reform title	Other document	No document	Total (1000s)	% of total	
	% of households						
<i>Share of producers by type of producer</i>							
% of total	43.28%	9.97%	2.89%	43.85%	100.00%		
Total (1000 s)	75.97	17.50	5.07	76.97	175.52	100.00%	
Small livestock	38.65%	6.84%	3.41%	51.10%	29.25	5.88%	
Large livestock	67.83%	15.20%	1.65%	15.33%	19.57	13.65%	
Small coffee	67.54%	14.81%	0.00%	17.65%	3.44	2.13%	
Large coffee	100.00%				5.05	5.63%	
Small maize and beans	28.43%	5.43%	2.21%	63.93%	47.67	17.51%	
Large maize and beans	57.75%	16.83%	2.73%	22.69%	22.58	17.06%	
Small mixed	29.95%	11.48%	3.27%	55.30%	25.35	34.33%	
Large mixed	48.67%	9.54%	5.56%	36.23%	22.62	3.82%	
	% of area					Total (1000 mzs)	
<i>Share of area by type of producer</i>							
% of total	77.63%	8.64%	3.11%	10.62%	100.00%		
Total (1000 mzs)	7065.93	786.88	283.03	966.47	9102.31	100.00%	
Small livestock	69.18%	11.49%	6.72%	12.61%	176.22	1.94%	
Large livestock	82.72%	7.74%	1.46%	8.08%	5737.67	63.04%	
Small coffee	100.00%				14.61	0.16%	
Large coffee	81.39%	6.69%	5.02%	6.90%	583.65	6.41%	
Small maize and beans	67.65%	9.45%	1.02%	21.88%	143.63	1.58%	
Large maize and beans	66.35%	13.52%	9.65%	10.48%	1537.98	16.90%	
Small mixed	46.35%	5.09%	5.62%	42.94%	99.12	1.09%	
Large mixed	67.30%	7.05%	0.32%	25.32%	809.43	8.89%	

Source: Own computations based on 1998 LSMS Survey (for population shares) and MAGFOR apante survey (for area shares).

about 10 times less than what is obtained by small producers, points to the presence of considerable differences in partial factor productivity. This implies that markets could equalize factor ratios across different types of producers. The fact the Gini coefficient for the operational distribution of land is, with 0.80, slightly lower than the Gini coefficient for the ownership distribution of land (0.86), suggests that the land rental market does indeed contribute to a modest equalization of operational land holdings. The extent of such a redistribution and the characteristics of participants will be explored in more detail below.

The second half of Table 4 illustrates this equalizing effect in more detail but at the same time also highlights that rental markets are far from leading to an equalization of land productivity. It is of interest to note that land

rental markets are relied upon by 23% of all producers and that 18% of these (or almost 80% of those renting in land) are completely landless. In addition to these 18% of pure tenants, more than 20% of producers rely on land that has been either invaded or "borrowed" for free. The high share of formal and informal rental activity, which is comparable to Asian countries (de Janvry, Gordillo, Platteau, & Sadoulet, 2002) underscores the relevance of well-functioning markets for equity.

The restricted scope of land rental markets is illustrated not only by the limited participation of land owning households but also by the scant amounts of land that are actually exchanged. Mean area rented per tenant remains comparatively small, something that is surprising in view of the great imbalances in owned area and the large number of households relying

on rental markets. Moreover, descriptive statistics based on the typology of producers introduced earlier are far from unambiguous. For coffee producers and livestock ranchers, there is no statistically significant difference between the share of producers renting out land in the "large" and the "small" group and the amount of land rented in by large ranchers exceeds what is being obtained by small producers by a factor of more than 10. Similarly, while there appears to be a higher propensity for renting land out among producers of traditional staples, a negative net rental, implying that the mean producer rents out rather than rents in land is observed only for diversified farms.

Concerning land sales markets, we note that about 2% of producers included in the sample have bought land in any of the 5 years preceding 1998, as highlighted in the bottom panel of Table 4.¹⁰ Looking at the incidence of land sales across farm size groups suggests, however, that even though there was participation by small farmers, the sales market may have effectively led to a re-concentration of land instead of transferring land to small producers. Purchase activity was particularly pronounced among coffee growers where almost 40% of the large producers and almost 30% of small producers report having bought land. The same pattern of significantly higher purchase activity by large than by small producers is also observed among all other groups with the exception of diversified farmers where, with 6%, land

purchase activity was relatively modest. This, together with the fact that the amount of net purchases was in all instances greater for large farms than it was for small farms suggests that impact of land sales markets was even less in line with what one would have expected under the assumption of perfectly functioning markets. While the fact that producers who sold all their land are not observed leads to underestimate this trend,¹¹ we can take the difference between the net sellers and net buyers as a rough indicator of a groups' relative competitiveness in the land sales market. This figure indicates that most of the net accumulation of land has been concentrated with large coffee and livestock producers.¹²

(c) *The productivity impact of the existing land distribution*

The literature has long emphasized that, as long as other market imperfections (e.g., in the market for credit) do not prevent them from realizing their productive potential, family-operated farms will be economically more efficient than large producers who rely on wage labor that requires costly supervision. This would imply that, in an economy without transaction costs, the land rental market should shift land to small producers and thereby enhance not only equity (as discussed above) but also economic efficiency. Even though the lack of panel data that could be used for this pur-

Table 4. *Partial productivity and land market participation among agricultural producers, Nicaragua 1998*

	Total	Livestock ranchers		Coffee growers		Maize and beans		Diversified farmers	
		Small	Large	Small	Large	Small	Large	Small	Large
<i>Partial productivity measures</i>									
Profits per mz (C\$/mz; median)	735	566	89	2,132	176	1,100	134	931	47
Per capita profits (median)	656	829	3,761	2,080	6,002	553	795	439	935
<i>Land market participation</i>									
Percentage of renters	22.6%	17.4%	13.6%	17.1%	0.0%	29.0%	13.2%	26.2%	1.3%
Percentage of landless tenants	18.3%	14.1%	5.5%	1.9%	0.0%	24.4%	5.9%	23.0%	0.0%
Pct. with land acquired informally	21.5%	22.9%	2.7%	0.0%	0.0%	27.2%	5.8%	18.0%	25.8%
Pct. of renters or invaders	44.0%	40.3%	16.4%	17.1%	0.0%	56.2%	19.0%	44.2%	27.0%
Pct. renting land out	5.8%	8.0%	9.3%	5.1%	0.0%	3.8%	10.6%	4.4%	12.9%
Net area rented in (mzs)	0.89	0.55	6.89	0.06	0.00	0.93	2.74	0.51	-0.23
Pct. net sellers in last 5 years	3.7%	2.4%	7.7%	6.4%	7.1%	2.7%	3.8%	6.2%	1.7%
Pct. net buyers in last 5 years	9.8%	10.0%	20.9%	28.5%	39.2%	7.9%	20.9%	6.6%	6.0%
Net purchased area (mzs)	1.82	3.30	5.59	1.07	47.20	0.40	6.60	-0.10	2.93

Source: Own computation from 1998 LSMS and MAGFOR Survey.

pose implies that we will not be able to completely eliminate unobservable household specific effects, a cross sectional pseudo-profit function can provide important indications as to whether such a relationship holds in rural Nicaragua.

To examine this issue, we estimate a pseudo profit function (using profits per mz constructed in the same way as discussed earlier) based on the 1,355 observations in the sample for which such data were available. We distinguish between land ownership and the actual operated land area. This distinction is justified since land ownership would, for example, affect households' ability to access credit and to self-insure. We would therefore expect a clearly positive impact, although it would be of interest to see whether there are significant differences between land and nonland assets. Operated area, on the other hand should be negative since increasing operational size would require farm operators to either reduce the intensity of cultivation or to resort to wage labor which is more difficult to supervise. Empirically, we use the value of land owned to explore the impact of land ownership and add operated area as another variable on the right-hand side to check for the presence of a negative relationship between farm size and productivity. As there are no data on the value of operated land, we use the log of operated area, together with dummies for the type of production undertaken (livestock, coffee, and maize and beans with diversified farmers being included in the intercept) to control for land quality differences. Other variables included are the household's experience in agriculture as well as off-farm employment, education, a dummy for male headship, and dummies indicating whether the village had access to technical assistance or credit.¹³

Results, as illustrated in Table 5, show a strong positive impact of land ownership (as measured by land values) on profits. By contrast to land ownership, the size of *operated* area enters significantly with a strong negative sign, and quantitatively quite important. The strong negative sign suggests that, by bringing land from large to small producers, land markets could perform an important function that would increase overall efficiency as well as equity. At the same time, the regression suggests that land to which no secure property rights are held does not contribute as much to an increase in profits. In fact, we cannot reject the hypothesis that the marginal impact of such land

on profits equals zero, suggesting that titling could make a tremendous contribution to increased agricultural profitability.

The lack of significance of other farm assets can be explained by the fact that many of these are likely to be absorbed in the dummies for livestock and coffee production, both of which are of considerable magnitude and high statistical significance. By contrast, nonfarm assets are significant and positive, suggesting that higher levels of such assets may help producers, for example, in overcoming liquidity constraints to gain access to credit. It is also of interest to note that this productivity-enhancing impact of land *ownership* remains valid even if indicators for the availability of credit and technical assistance at the municipal level are included in the regression. In fact, having technical assistance available is estimated to increase profits by about 22% while the point estimate for availability of credit is almost 30%, suggesting high returns for provision of public goods. This is of particular relevance as, according to the evidence from the survey, the success of the measures aimed to increase access to technical assistance for small producers appears to have been limited.¹⁴

A number of other interesting results emerge from the regression. Male headship increases productivity by about 25%, something that can be interpreted as implying that labor markets in rural Nicaragua are incomplete and that, as a consequence, female-headed households might have difficulty obtaining the labor supply needed to complete heavy chores in a high-quality and timely manner. In line with this hypothesis, higher levels of family labor, as measured by the number of adult household members available, help to increase profits; one other member is associated with an increase in profits by about 8%. While we estimate no significant returns to agricultural experience, off-farm experience is estimated to be associated with lower agricultural profits, something that would be plausible if part of the time of such households is still devoted to pursuing off-farm tasks. Finally, and quite relevant in view of the low levels of education in the sample, we also find positive and relatively high returns to education; completing an additional year of schooling would, according to the regression, increase agricultural profits by 2.6%. Applied to our sample this would imply that increasing the level of education for rural workers to that of the urban population would increase agricultural productivity by about 10%.

Table 5. *Regression of profits from agricultural production on fixed factors, Nicaragua 1998*

	Specification with	
	Regional dummies	Municipio dummies
Education of head (years)	0.029** (2.36) ^a	0.026** (1.99)
Male head dummy	0.234** (2.07)	0.262** (2.25)
Agricultural experience (years)	0.004 (0.30)	0.005 (0.34)
Off-farm experience (years)	-0.072*** (2.82)	-0.076*** (2.84)
Land value in C\$ (log)	0.030*** (2.96)	0.027** (2.54)
Land value × No title dummy	-0.038*** (3.39)	-0.032*** (2.81)
Operated land (log)	-0.635*** (9.00)	-0.616*** (8.28)
Operated land (log squared)	-0.011 (0.84)	-0.007 (0.49)
Value of farm assets in C\$ (log)	0.003 (0.35)	0.009 (0.98)
Value of nonfarm assets in C\$ (log)	0.033*** (3.53)	0.027*** (2.76)
Credit access dummy ^b	0.245** (2.16)	0.227* (1.95)
Technical assistance dummy	0.273*** (2.69)	0.227** (2.17)
Family labor (number of people)	0.076** (2.48)	0.081** (2.57)
Livestock dummy	0.479*** (4.90)	0.524*** (5.02)
Coffee dummy	0.691*** (3.74)	0.337 (1.55)
Maize and beans dummy	0.133 (1.50)	0.148 (1.55)
Intercept	6.779*** (34.56)	6.596*** (26.44)
No. of observations	1352	1352
R ² adj	0.409	0.436

^a Absolute value of *t*-statistics in parentheses.

^b As the intention was to measure availability of infrastructure, dummies for credit and technical assistance were set equal to one if somebody in the community other than the producer under concern had access to credit.

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

Taken together, these results support the hypothesis that rural areas in Nicaragua are characterized by multiple market imperfections and that, by helping to overcome some of these imperfections, e.g., through provision of public goods, government policy can have a significant impact on overall profitability. We explore the implications concerning the land market in more detail below.

4. DETERMINANTS OF LAND MARKET FUNCTIONING

The evidence thus far, of a highly unequal land ownership distribution but a negative relationship between operated area and agricultural profits suggests that well-functioning land markets would have an important role to play in equalizing the operational distribution of

land. It is well known that imperfections in credit markets, together with distortions in prices of agricultural land may prevent land sales from leading to rapid equalization of the land holding pattern. Land rental markets however, do not suffer from this disadvantage and should therefore contribute to increased equity as well as efficiency. The purpose of this section is to test empirically the hypotheses that households with low land endowments (per unit of family labor) would obtain additional land in (rental or sales) markets while those with high endowments would offer land in the market. In doing so, we try to identify significant differences between land sales and land rental markets, how different policy instruments (e.g., title) affect land market participation, and how the behavior of markets changed over time.

(a) *Nonparametric comparison of the performance of land markets*

To obtain an initial idea of different farmers' demand for land, we perform nonparametric regressions of net purchases and net rentals of land against the amount of land owned per adult family member. The purpose of normalizing by the number of family members is to account for the availability of family labor, something that would be of particular importance in situations where labor markets are imperfect. The nonparametric technique, which consists of running a large number of regressions of the dependent on the independent variable and plotting the result in a smooth graph, avoids the parametric assumptions that are inherent in traditional regression techniques and, by "letting the data speak," allows to better depict nonlinear relationships.

Results for the sales market (Figure 1)¹⁵ indicate that, instead of supplying land to the market and completely opposite of what would be predicted on efficiency grounds, large land owners are potent demanders of land. This suggests that, in 1998, land sales markets were not responding to considerations of efficiency. Moreover, unfettered operation of such markets would have increased inequality of land ownership and, if the estimates reported above are any guide, also decreased productive efficiency. Identification of factors that contribute to such performance, and of policy measures to counteract them in land sales markets would be of great importance. On the supply side, such measures could, for example, include effective

collection of land taxes so as to increase the cost of speculative land holding (Strasma, Shearer, & Waldstein, 1987). As regards demand, measures to strengthen small farmers' access to markets and their ability to compete, to provide them with sources of long-term capital, and possibly to facilitate establishment of infrastructure needed in the context of subdividing large farms, might be considered.

In contrast to land sales markets, rental markets show a clearer decline in net demand with holding size. As Figure 2 illustrates, demand for renting in, which is highest for completely landless people, becomes negative at about 50 mzs per adult. Beyond this point producers tend to rent out land, thereby bringing down their operational holding size to a more "optimal" level. While this suggests that there were indeed significant differences between land sales and land rental markets, the magnitudes involved are generally small—as illustrated in Figure 1, the amount of land supplied to the market even by the largest farm groups amounted only to 2 mzs, a negligible amount for a farm of 500–600 mzs in total. Policy measures to improve the functioning of the land rental market should therefore be high on the list of government priorities.

To assess whether the reforms adopted in the 1995–98 period affected the performance of land markets, it is instructive to compare the operation of these markets over time. Repeating the nonparametric analysis for land sales and rental markets with data from 1995 suggests that, for rental but not for sales markets, there was a clear structural shift between the two periods. Figure 2 illustrates that the regression for sales markets is virtually indistinguishable from the one for 1998, i.e., there was little change in the incentive for land accumulation by large farmers. By contrast, land rental markets in 1995 behaved very differently from 1998, and very much in line with land sales markets. Completely opposite to what was observed in 1995, demand for purchases of land was flat up to a land endowment of 50 mzs per adult but then *increased* steeply thereafter. This suggests that under the policy regime in place then, both land sales and land rental markets were associated with transfers from small to large producers that are likely to have been economically inefficient.

This suggests that the main impact of the policy changes implemented since 1995 appears to have been that large landowners shifted from being net demanders to becoming net suppliers

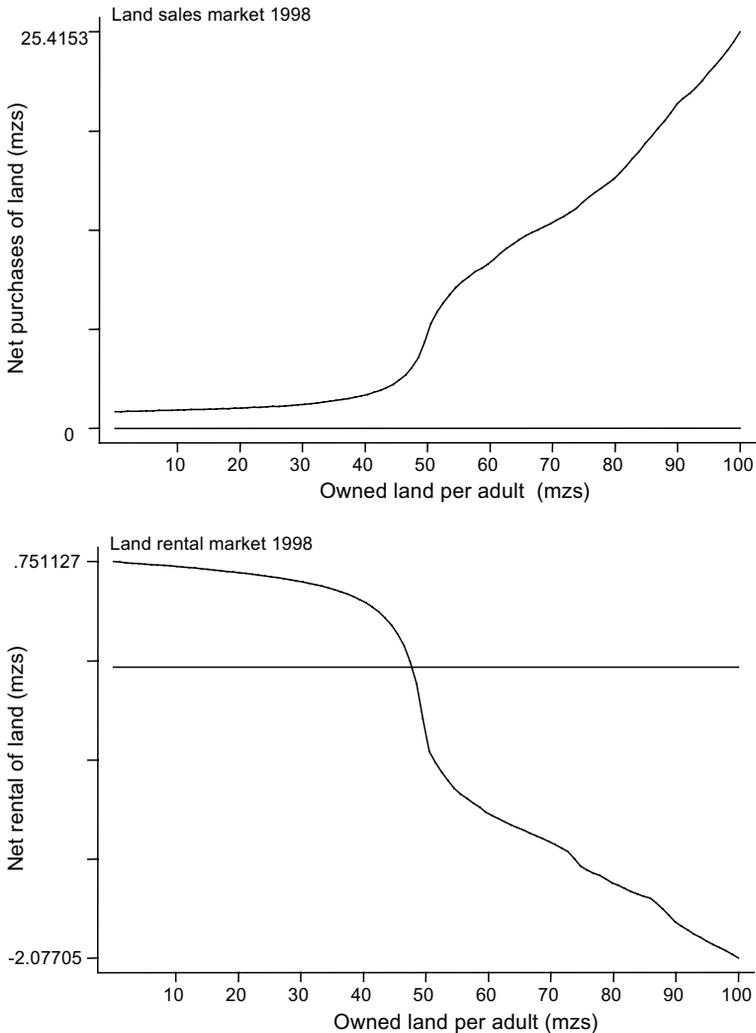


Figure 1. *Nonparametric regression of net rented and purchased area on owned area, 1998.*

of land in rental but not in sales markets. At the same time, there is little difference in the net demand of farmers with an endowment below 50 mzs. While it was no longer profitable for large farms to acquire additional land through the rental market, the reforms have had relatively little impact on the demand side in the sense that small producers who appear to still have lacked the prerequisites to translate economic efficiency into effective demand not only in the land purchase market but also for rentals. An explanation that would be consistent with this evidence is that the macroeconomic reforms affected productivity of large farms,

making it less desirable economically to operate large areas of land, but that noneconomic and speculative factors that affected demand for land ownership have not yet been eliminated. In fact, this result illustrates both the scope and the limitations of an adjustment in price policy that is not accompanied by other measures to improve access to markets and technology by small producers. It is in line with the observation that it may be a middle stratum of farmers who are, without support from government, most able to exercise effective demand in land markets (Carter & Zimmerman, 2000) and that more specific measures to improve the func-

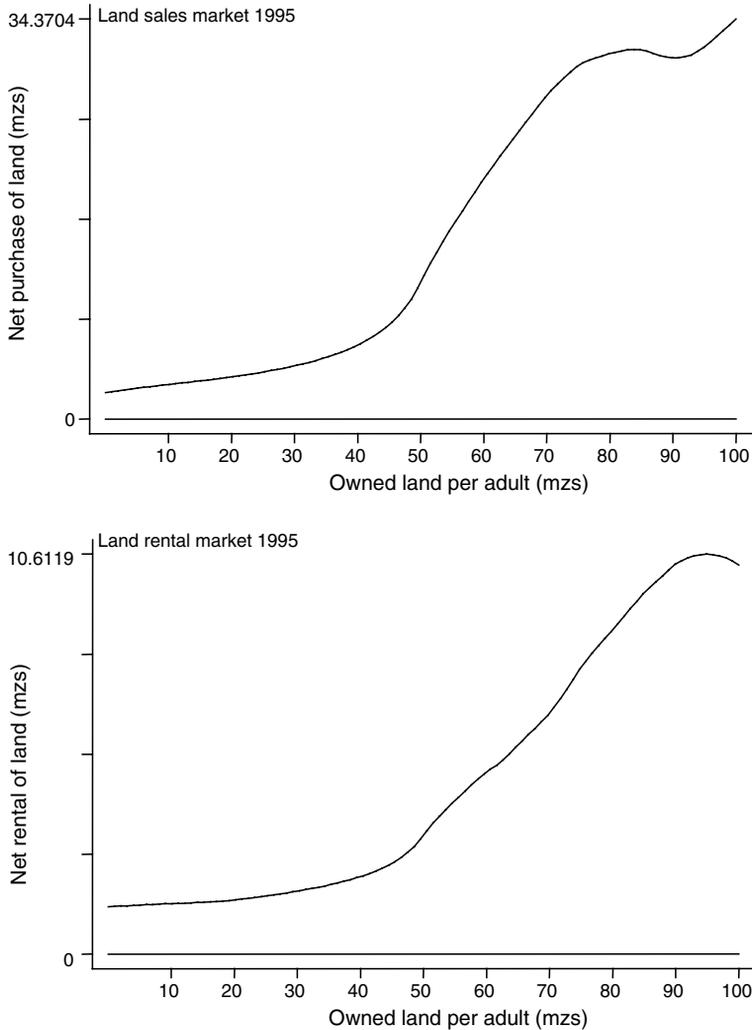


Figure 2. Nonparametric regression of net rented and purchased area on owned area, 1995.

tioning of other markets will be required if small farmers are to take advantage of the opportunities offered in better functioning land markets.

(b) *Parametric evidence on the performance of rental and sales markets*

Although nonparametric techniques provide an intuitive graphical illustration, they do not adjust for the impact of other variables. To incorporate these, we complement the above with regression analysis. Since there are reasons to believe that having title to land will affect

supply of land to the market but not demand, we estimate tobit models for the supply and demand for land in the land sales and rental markets, respectively, rather than an ordered probit model.

Table 6 highlights results for the supply of land to the rental and sales market, respectively. One notes that the only variable that is significant in the *sales* equation is the amount of land owned. In line with the evidence from the nonparametric regression, and contrary to what one would expect on grounds of economic efficiency, higher land endowments are estimated to decrease rather than increase supply

Table 6. *Tobit models for renting out and selling land, Nicaragua 1998*

	Renting out coeff.	Selling coeff.
Family labor endowment	-0.373 (0.92) ^a	-0.916 (0.48)
Total land owned	0.019** (2.11)	-0.055** (2.17)
Age of head	0.095** (2.07)	-0.257 (1.10)
Years of education by head	0.578** (2.32)	-0.195 (0.16)
Value of farm assets (1000 C\$)	-0.01 (0.41)	0.350 (1.10)
Value of nonfarm assets (1000 C\$)	0.04* (1.69)	-0.083 (0.85)
Lack of title dummy ^b	-5.630*** (3.31)	6.551 (0.85)
Dummies included	Municipio	Department
No. of observations	1,271	1,223
Log likelihood	-467.04	-428.79

^a Absolute value of *t*-statistics in parentheses.

^b For households who had both titled and untitled land, the value of the dummy indicates whether the majority of land owned is titled or untitled.

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

to the sales market. This finding would be consistent not only with the interpretation that

households hold land for nonproductive purposes, e.g., for speculation or because of the prestige value that is provided by land ownership. At the same time, it suggests that considerable imperfections in land sales markets may persist. Even though it is difficult politically, it has been suggested to use taxation of land as a possibly more effective instrument to increase the implicit cost of holding land unproductively (Strasma *et al.*, 1987).

By contrast, in the rental market, higher levels of land ownership are estimated to increase supply to the market, even though the magnitude of the marginal effect is relatively modest (see Table 7). Other factors increasing supply to the rental market are the age and level of education of the household head and the level of education. This is in line with the notion that households who are either too old or who have more lucrative opportunities in other parts of the economy are likely to leave their land to others. In this context, the quantitatively large coefficient on the "lack of title" variable is of interest. The danger of losing land at the end of the rental period (because the tenant acquires implicit ownership rights that would make it difficult to evict him or her) could be an important impediment to better functioning of land rental markets. As a consequence, it may be considerably more risky to

Table 7. *Tobit models for renting in and purchasing land, Nicaragua 1998^a*

	Renting in		Purchasing	
	Coeff.	Coeff.	Coeff.	Coeff.
Family labor endowment	1.081*** (3.20) ^b	1.103*** (3.31)	-0.698 (0.34)	-1.178 (0.58)
Total land owned	-0.148*** (4.50)	-0.183*** (5.07)	0.033 (0.98)	0.075 (1.86)
Age of household head	-0.131*** (3.15)	-0.116*** (2.79)	0.23911 (1.02)	-0.335 (1.40)
Yrs. of education	-0.902*** (3.82)	-0.868*** (3.58)	-0.21931 (0.19)	-0.315 (0.27)
Value of farm assets	1.04E-05 (0.88)	5.46E-06 (0.45)	2.52E-05 (0.36)	2.17E-05 (0.33)
Value of nonfarm assets	8.51E-06 (0.37)	1.54E-05 (0.68)	2.62E-04*** (2.86)	3.27E-04*** (2.96)
Intercept	-7.578** (2.56)		-52.549*** (3.27)	
Type of dummy	Province	Municipio	Province	Municipio
No. of observations	1,271	1,271	1,223	1,223
Log likelihood	-1606.5	-1513.6	-1135.1	-1063.1

^a Regional dummies included but not reported.

^b Absolute value of *t*-statistics in parentheses.

get back land to which no formal title is held than it is to retrieve land that is clearly registered. The coefficient supports this notion that lack of title is likely to be a strong disincentive for renting out land.¹⁶ Still, the fact that such markets have hardly reached poor small producers suggests that there is also need for improving the functioning of other markets if this is to be successful.

Estimation of the corresponding land demand equations supports the hypothesis that the factors underlying the operation of land rental and sales markets are quite different. Results are illustrated in Table 7. The land purchase equation demonstrates that land acquisition in the sales market continues to be driven mainly by ownership of nonagricultural assets. This, together with the fact that the coefficients on other variables such as ownership of land, labor endowments, and ownership of other farm assets are insignificant, points toward the continuing importance of factors that are not necessarily related to agricultural productivity. This could imply that land purchases may still be undertaken as a means for offsetting taxable profits by rich entrepreneurs from the nonfarm sector or for noneconomic and status-related reasons. At the same time, it might mean that the lack of long-term capital is an important constraint to land acquisition and greater activity in the land sales market. Consistent with the earlier discussion, land-scarce households, i.e., those with high labor endowments and low amounts of own land, are most likely to demand land in the rental market. Demand for land rental is particularly high among young households, something that points toward the role of rental markets within the family life cycle. In addition, more educated households are less likely to demand land in the rental market, thereby highlighting not only that education can substitute for land access but also underscoring the importance of land rental for the poorer parts of the population who lack alternative assets and human capital to capitalize on opportunities in the off-farm labor markets.

5. CONCLUSION

Analysis of evidence from Nicaragua provides a number of insights that can contribute to the debate on the performance of land markets in developing countries. While our

figures highlight that much remains to be done in order to achieve the goal of secure tenure for Nicaragua's rural producers, the available evidence clearly shows that past policies did not only increase tenure security but also had an impact on productive performance and the operation of land markets. There is, therefore, a strong case, both in terms of equity as well as efficiency, for targeting such interventions more explicitly toward the poor who seem to often not have had the means (monetary or otherwise) to afford registration. Even after the elimination of policies that preferentially benefited large farmers, noneconomic factors that favor land concentration seem to remain and identification of these factors and their inclusion in the policy agenda would be important. Anecdotal evidence suggests that, to a large extent, the process of unproductive re-concentration of land may be driven by tenure insecurity and lack of access to legal advice or means to enforce the law which causes small farmers to sell off their land (Merlet & Pommier, 2000). This, together with the fact that insecure tenure increasingly seems to affect the "nonreform" sector as well, such efforts should be integrated into a more systematic and comprehensive solution to the problem of tenure insecurity.

A second finding of interest is that, even though there are considerable differences in productivity between large and small farmers, pervasive market imperfections imply that this may not be translated into effective demand in land sales or even rental markets. Even though we note that policy reforms undertaken during the 1990s have affected the functioning of rental (but not of sales) markets, this suggests that, in order to have maximum impact, interventions to increase tenure security need to be put into a more comprehensive context that aims to provide access to information, technology, and infrastructure, so as to enable small farmers to make optimum use of their endowment. This is supported by the fact that, despite a high level of activity, the amount of land transferred to small producers in rental markets remains limited. An adequate macro and incentive framework thus appears to be a necessary but not a sufficient condition for well-functioning land markets. For land markets to realize their potential in a more liberalized environment, access to public goods and other markets, as well as an appropriate legal and institutional framework will be necessary.

In addition to better targeting of titling efforts to the poor, complementing them with policies that would facilitate more effective use of the land by the disadvantaged remains a major challenge not only for Nicaragua but also for other governments in the region.

NOTES

1. It is estimated that about 5,200 properties with 2.9 mn mzs, in addition to about 0.8 mn mzs which were transferred during the final months of the Sandinista regime, many of them in valuable urban properties, were given out without first having been properly registered in the name of the state (Strasma, 2000).
2. While project efforts were centered on specific geographic areas with high incidence of land reform beneficiaries, free titling within these areas was undertaken on demand and there was little effort to systematically resolve conflicts or provide information. This may have created large benefits for the wealthier, possibly leaving out households suffering from insecure tenure and not having adequate access to information about the program.
3. The cost of doing so was enormous and were of broader economic significance even though issuance of bonds has helped to reduce them somewhat. As of June 2000, the Government had spent US\$0.8 bn in compensation even though only about a third of the claims had been settled.
4. The open-ended nature of the process of filing claims, together with the possibility of landlords pursuing administrative and legal channels separately and independently from each other encourages continued litigation and strategic bargaining, rather than a quick solution of the problems. While mechanisms exist for poor beneficiaries to seek certificates (*solvencias*) that certify their legitimate possession of land and subsequently register their interest, high transaction costs, unclear procedures, and severe understaffing imply that tenure insecurity remains pervasive. Field studies indicate that many former cooperatives are being successively decapitalized by their need to hire lawyers and fight lawsuits. Legal assistance and a more decentralized structure will be essential for this (Merlet & Pommier, 2000).
5. Indeed, in the case of Brazil, macroeconomic liberalization, together with the elimination of subsidized credit which had benefited mainly large producers has led to a drop of about 70% in land prices, making it possible to greatly expand programs to provide access to land for small producers (Teofilo, 2002).
6. A household is classified as self-employed if more than 50% of income is derived from self-employment.
7. This "financing paradox of the poor" has been analyzed in the literature both conceptually and empirically (Binswanger & Elgin, 1988; Carter & Mesbah, 1993).
8. Given the nature of the survey it was impossible to insist on checking the accuracy of producers' response, e.g., through physical examination of their title or document. It is normally believed that, for example, to reduce the risk of challenges, respondents normally have an incentive to overstate the extent of their tenure security. Thus, the figures provided here are a lower bound for the area and producers lacking formal documentation, implying that the true extent of tenure insecurity may be much higher than is given here. Government institutions have no updated data on the registration status of different areas that could be used to crosscheck our results and the generation of such statistics would be high on the list of priorities for further intervention. As indicated in Table 3, the area estimates are based on the MAGFOR survey which excludes the Atlantic while the household-level estimates are based on the LSMS.
9. Although the link cannot be interpreted in a causal way (since coffee generates higher returns that can be used to finance the costs associated with obtaining title), the fact that the degree of land rights regularization is much higher in the coffee sector is certainly more than a coincidence and suggests that, with a more comprehensive solution of the land tenure problem, rural investment in Nicaragua could actually have been much higher.
10. While great care was taken in the survey to obtain land sales from all households included in the sample and thus avoid dropping those who left the sector entirely, the information obtained may nonetheless be incomplete.
11. Attempts to overcome this constraint by asking households for past land sales and losses were not very successful.

12. As we do not observe the second side to the transaction (to whom the farmer sold or from whom he purchased the land), we are unable to ascertain whether transactions occurred within the same group of producers or across different classes (e.g., between large and small ones or from maize and beans producers to coffee growers).
13. These dummies equal one if somebody in the village other than the producer under concern had access to credit or technical assistance and zero otherwise.
14. Survey results indicate that, compared to the reduction in credit, access to technical assistance has increased between the two survey periods, from 11% to 14% of producers, through expansion of both the public private sector.
15. We use the Epachevnikov kernel with a bandwidth of 50 throughout and limit the analysis to farms in the range between 0 and 100 mzs per adult.
16. This finding highlights the secure land ownership, in the case of Nicaragua formally registered title, is an important pre-condition for effective functioning of rental markets. Activation of land rental markets could be an additional benefit from land titling, over and above the emphasis on investment and credit access that has traditionally been emphasized in the literature. Nevertheless, the fact that, as discussed earlier, large producers in Nicaragua have generally secure title, highlights the importance of considering demand for land rental at the same time.

REFERENCES

- Alston, L. J., Mueller, B., & Libecap, G. (1999). *Titles, conflict, and land use: the development of property rights and land reform on the Brazilian Amazon frontier. Economics, cognition, and society series*. Ann Arbor: University of Michigan Press.
- Barham, B., Carter, M. R., & Sigelko, W. (1995). Agro-export production and peasant land access: examining the dynamic between adoption and accumulation. *Journal of Development Economics*, 46(1), 85–107.
- Baumeister, E. (1999). *Las iniciativas campesinas y la sostenibilidad de los resultados de la reforma agraria en El Salvador*, Nicaragua, y Honduras, UNRISD Discussion Paper 105, UNRISD, Geneva.
- Binswanger, H. P., & Elgin, M. (1988). What are the prospects for land reform?. In A. Maunder, & A. Valdes (Eds.), *Agriculture and governments in an interdependent world. Proceedings of the Twentieth International Conference of Agricultural Economists*. Aldershot: Ashgate.
- Binswanger, H. P., 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* (vol. 3, pp. 2659–2772). Amsterdam; New York and Oxford: Elsevier Science, North Holland.
- Brockett, C. D. (1998). *Land, power and poverty: agrarian transformation and political conflict in Central America*. Boston: Unwin Hyman.
- Carter, M. R., & Barham, B. (1996). Level playing fields and laissez faire: postliberal development strategy in inegalitarian agrarian economies. *World Development*, 24(7), 1133–1149.
- Carter, M. R., & Mesbah, D. (1993). Can land market reform mitigate the exclusionary aspects of rapid agro-export growth? *World Development*, 21(7), 1085–1100.
- Carter, M. R., & Zimmerman, F. J. (2000). The dynamic cost and persistence of asset inequality in an agrarian economy. *Journal of Development Economics*, 63(2), 265–302.
- Corral, L., & Reardon, T. (2001). Rural nonfarm incomes in Nicaragua. *World Development*, 29(3), 427–442.
- Davis, B., Calogero, C., Sil, J. (1997). *Los hogares agropecuarios en Nicaragua: un analisis de tipologia*, FAO, Rome.
- de Janvry, A., Gordillo, G., Platteau, J. P., & Sadoulet, E. (2002). *Access to land, rural poverty, and public action*. Oxford: Oxford University Press.
- de Soto, H. (2000). *The mystery of capital: why capitalism triumphs in the west and fails everywhere else*. New York: Basic Books.
- Deininger, K., Chamorro, J. S. (in press). Investment and income effects of land regularization: the case of Nicaragua. *Agricultural Economics*.
- Deininger, K., & Olinto, P. (2001). Rural nonfarm employment and income diversification in Colombia. *World Development*, 29(3), 455–465.
- Gobierno de Nicaragua (1999). *Indicadores basicos del Sector Agropecuario*, Mimeo, Managua.
- Jalan, J., & Ravallion, M. (1999). Are the poor less well insured? Evidence on vulnerability to income risk in rural China. *Journal of Development Economics*, 58(1), 61–81.
- Keynan, G., Olin, M., & Dinar, A. (1997). Cofinanced public extension in Nicaragua. *World Bank Research Observer*, 12(2), 225–247.
- Merlet, M., & Pommier, D. (2000). *Estudios sobre tenencia de la tierra*. IRAM (Institut de Recherches et d'Applications des Methodes de Developpement), Managua.
- Pelupessey, W. (2000). *Agrarian policies in Central America*. New York: St. Martin's Press.
- Steiner, M. (1999). *Encuesta de granos basicos: disenyo de la muestra*, Mimeo, Managua.
- Strasma, J. (2000). *Land tenure in Nicaragua: analysis and future perspectives*. FAO Land Tenure Service, Rome.

- Strasma, J., Shearer, J., & Waldstein, E. (1987). *Impact of agricultural land revenue systems on agricultural land usage*. Madison, WI: Land Tenure Center.
- Teofilo, E. (2002). *Country case study Brazil*. World Bank Regional Workshop on Land Policy Issues, Pachuca, Mexico, May 19–22.