LAND MARKETS IN UGANDA: INCIDENCE, IMPACT AND EVOLUTION OVER TIME

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ABSTRACT

Although there is broad agreement that well functioning land rental markets will play an important role to increase productivity and household welfare as agrarian economies develop, evidence from Africa on the actual performance and impact of such markets is limited. We use data from Uganda to test for differences in the performance of rental, as compared to sales markets and their evolution over time, based on a framework where markets are affected by differences in ability and imperfections in rural labor and capital markets. We find that land markets are very active, that land rental but not sales markets transfer land to more efficient and relatively poor producers thereby providing an opportunity for the landless to access land, and that rental market activity has increased recently with economic growth. Despite land prices in some regions being above the net present value of land we find no evidence for sales markets leading to land concentration and conclude that, rather than imposing administrative restrictions, government should aim to improve access to alternative savings instruments.

INTRODUCTION

It is well known that in situations where risk is high, credit markets are imperfect, and non-agricultural uses drive land purchase demand, land sales markets may not bring the ownership distribution of land closer to the optimum and may, in certain circumstances, lower overall productivity (Binswanger et al. 1995). Fear of such efficiency-reducing outcomes has led a number of countries to impose restrictions on the operation of land sales or rental markets (e.g. Ethiopia, India, Mexico, China) and is prompting researchers and policy-makers to caution against premature liberalization of land markets. While it is often argued that restrictions on the functioning of markets would be justified in Africa, the empirical literature on this topic suffers from two deficiencies.

First, while there is a significant literature on land markets focusing on Asia and Latin America, more in-depth study of land markets in the African context has started to emerge only very recently (Lavigne-Delville et al. 2002; Place 2002 provide overviews), and often rely on case studies or very small samples. While this provides interesting insights into the mechanisms at work, it is not clear to what extent the results obtained can be generalized and thus be used for policy-making in a more general context.

Second, even though one would expect land sales and rental markets to work quite differently, there is often insufficient distinction between the two, with few exceptions (e.g. Baland et al., 2001). This is important because, even in situations where, due to high risk, imperfect markets for credit and insurance, the limited ability to use land as a collateral, and high levels of non-agricultural demand for land, the scope for land sales markets to lead to socially undesirable outcomes may be high, rental markets can lead to efficiency-enhancing outcomes. Temporary exchange of land between producers, and across generations is likely to become of increasing importance as the rural economy develops and off-farm employment opportunities emerge, implying that land rental markets will be of high importance and could make a contribution to overall development, which would be missed if the two channels were not differentiated.

In this paper we aim to address these two shortcomings by providing evidence on land rental and sales markets separately for Uganda, using a large nationally representative household survey. Conceptually, and in line with the literature, we assume that land markets are driven by three factors, namely (i) households' unobserved agricultural ability; (ii) labor market imperfections in the form of supervision constraints; (iii) and capital market imperfections. With differences in ability, it will be advantageous to transfer land from less able to more skilled producers so as to enhance overall output, holding other things constant.

Labor market imperfections would tend to transfer land from large producers, who would have to rely on wage labor, to small producers whose family labor is not fully utilized by cultivating their endowment. Finally, capital market imperfections would imply that even in rental markets small but efficient producers may not be able to capitalize on their advantage because they do not have access to the necessary inputs. They would have even more important implications on land sales markets where absence of long-term finance and lack of insurance options are likely to have the opposite effect, i.e. to transfer land from small to large farmers.

Based on this framework, we explore three issues: First, we are interested to assess the importance and possible interaction between land sales and rental markets. Questions to be addressed include whether land sales and/or rental markets contribute to land concentration in the hands of the better off, whether sale and rental prices are in line with the returns to be had from agricultural cultivation or overvalued due to non-agricultural demand, thereby putting land out of the reach for the poor. Availability of two cross-sectional surveys in 1992/93 and 1999/2000 also allows us to make an assessment of the extent to which these factors have changed over time. We find that land rental markets are more important than land sales markets and that, in view of the low prices involved, they are more likely to have a very positive impact on household welfare.

Second, we draw conclusions regarding the impact of land markets on productivity and equity. To do so, we separately estimate equations for producers' participation in land sales and rental markets. Asset ownership and other socio-economic characteristics are used to determine the equity impact while a measure of producers' agricultural ability, constructed from a panel production function, indicates markets' impact on productivity. In doing so, a key goal is to identify not only the determinants of market participation but also the presence of systematic differences between rental and sales markets. We find that, in line with theory, land rental markets transfer land to more efficient and land-scarce or even landless households. Land sales markets, by comparison, are less redistributive and require an initial level of asset endowment. Still, we find no evidence of land concentration over time, suggesting that despite the overvaluation of land, the tendency towards land concentration is counteracted by the increased availability of alternative savings instruments.

Finally, we explore whether the extent of activity, and the characteristics of participants, in land rental markets have changed systematically over time. To do so, we pool the two samples, asking in particular whether recent liberalization of the agricultural sector has weakened the pro-poor impact of this market. The evidence leads us to conclude that growth of the non-farm economy, associated with improvement of economic conditions in the 1990s, has led to an increased level of activity in land rental markets, lowering the importance of household assets and higher relevance of agricultural assets. This suggests not only that rental markets will continue to fulfill an important function in rural Uganda but also that there is very little wealth-bias and are essential tool to achieve higher rural productivity.

The paper is structured as follows. Section 2 reviews the literature on land markets in Africa and presents the analytical framework, and the estimation strategy. Section 3 discusses data, descriptive evidence, and variable definitions. Econometric results are presented in section 4, and section 5 concludes with a number of policy implications.

BACKGROUND AND ANALYTICAL FRAMEWORK

To set the stage, we briefly review the literature on land markets in Africa and then introduce the conceptual model and the hypotheses to be tested empirically. While this suggests that land markets in Africa are more active than many believe, little evidence is available on how market prices compare to capitalized values from agricultural production and thus the potential, let alone the actual contribution of land sales markets to rural productivity and making judgments on these based on existing household surveys is difficult for a

number of reasons. To explore these, we first discuss the conceptual model and then provide empirical evidence.

Land rental and sales markets in Africa
The incidence of land rental and sales markets differs considerably across the different regions of the continent. In West Africa, where land ownership by indigenous communities was never seriously questioned and colonial administrations aimed to integrate local populations into commercial production, rental markets have a long-standing tradition and have evolved dynamically in response to increased land scarcity. In the humid areas of Cameroon, Nigeria, Benin, Ghana, Cote d'Ivoire, and Sierra Leone, complex mechanisms to transfer land and tree rights have been common since the 19th century, often linked to the recipient making long-term investments, blurring the line to land sales (Chauveau 2000, Amanor 2001, Edja 2001). Population growth and limited development of the off-farm economy imply that land rental rates are increasing and that rental transactions become more widespread and formalized, often involving use of witnesses. Rentals may even be used within households or across generations. In Western Ghana, the proportion of land acquired through purchase, on average between 4-5%, reached up to 18.8% in some migrant villages and tenancy transactions were shown to equalize the land ownership distribution (Quisumbing et al, 2001). Case studies support the notion that rental markets have a positive impact and are beneficial for women (Place, 2002). Despite this importance, a number of countries still fail to formally recognize land rental transactions (Delville et al. 2002).

In Southern Africa, rentals are rare, partly because of relative land abundance (for example in Zambia) but mostly because of the rigid division of the land into "black reserves" that were used mainly for semi-subsistence producers and areas reserved for whites which depended on migrant workers (Place, 1995; Place and Otsuka 2001; Zeller et al. 1997). In fact, in some cases, rentals seem to be used as a short-term coping mechanism by households hit by AIDS (Drimie, 2002). While many of the regulations that had historically precluded the development of a land rental market have been eliminated, land reform policy and strong tenancy protection laws in some of the countries will affect the development of the market.

In Eastern Africa, activity in land sales and rental markets appear to be high, except where, as in the case of Ethiopia, Government explicitly prohibits such transactions. Similarly, sales market transactions have been observed for a long time in specific countries such as Tanzania, Nigeria, and Sudan (Feder and Noronha 1997). Evidence from Sudan also suggests that land rental markets transfer land to smaller producers (Kevane 1996). In central Uganda, 58% of landholders reported to have purchased land as early as the 1950s (Mukwaya 1953), and land markets seem to have been quite active ever since (Place 1995; Baland et al. 2001). In Ethiopia, a land policy that makes land rights conditional on residence in the community discourages off-farm activities and migration, and is not necessarily conducive to investment or rural development (Rahmato, 1999).

Conceptual framework and approach
Let household i be endowed with fixed amounts of labor ($\overline{L}_i$) and land ($\overline{A}_i$), and a given level of agricultural ability (α_i). Relative land abundance is assumed to make farming based on hired labor infeasible and households can allocate their labor endowment between farming their own land and off-farm employment at an exogenous wage (w_i). Renting incurs transaction costs (T) proportional to the amount of land transferred and we assume that working capital is not binding. With this, household i will choose l^{a*}, l^{o*} as well as A^* by solving the maximization problem:

$$\underset{l^a, A}{Max}\; pa_i f(l_i^a, A_i) + wl_i^o + I^{in}(A_i - \overline{A}_i)(r + T) + I^{out}(\overline{A} - A_i)(r - T) \qquad (P)$$

where p is the price of agricultural goods, l^o is the amount of time allocated to off-farm labor ($= \overline{L}_i - l_i^a$), I^{in} is an indicator for rent-in (=1 for rent-in, and 0 otherwise), similarly I^{out} is an indicator for rent-out (=1 for rent-out, and 0 otherwise), and all other variables in (a) are as defined above. The optimal choices of l_i^{a*}, l_i^{o*} and A_i^* will solve the first order conditions (FOC) of problem (P), i.e.

$$p\alpha_i f_{l_i^a}(l_i^a, A_i) = w \qquad (1)$$

plus, for households who rent in, $\qquad p\alpha_i f_{A_i}(l_i^a, A_i) = r + T \qquad (2)$

or for households who rent out, $\qquad p\alpha_i f_{A_i}(l_i^a, A_i) = r - T$ $\qquad\qquad$ (2)

and for autarkic households, $\qquad r - T < p\alpha_i f_{A_i}(l_i^a, A_i) < r + T$ $\qquad\qquad$ (2)

The first order conditions allow to derive three empirically testable propositions (see Deininger and Jin, 2002 for a detailed derivation) as follows:

Proposition 1. The amount of land rented in is strictly increasing in ability, α, and strictly decreasing in their land endowment $\overline{A}$. Therefore, rental markets will transfer land to "poor but efficient" producers.

Proposition 2. Transaction costs drive a wedge between those renting in and those renting out with any increase in T decreasing α_l and increasing α_u, thereby expanding the range of producers who remain in autarky, reducing the number of households who participate in rental markets, as well as the amount of land transacted through rental markets. Reduction in transaction cost will increase social welfare.

Proposition 3. Increases of the wage for off-farm employment will increase the amount of land transacted in rental markets and overall welfare. This will be associated with a decrease in the equilibrium rental rate and, in a risk-free environment, will make everybody better off.

Concerning land sales markets, we follow the literature on inter-temporal asset accumulation. In general, household *i's* choice over consumption, land accumulation and saving in each period solves the utility maximization over the life time horizon (for notation brevity, we suppress the subscript *i*):

$$\text{Max} \qquad V = E_t \sum_{k=0}^{T-t} (1+\delta)^{-k} U(c_{t+k}) \qquad\qquad (3)$$

$$\text{Subject to} \qquad c_{t+k} + (\overline{A}_{t+k} - \overline{A}_{t+k-1})p_{t+k} + (S_{t+k} - S_{t+k-1}) \leq Y_{t+k}(\overline{A}_{t+k}) \qquad (3a)$$

$$\text{and} \qquad \overline{A}_{t+k} \geq 0 \qquad\qquad (3b)$$

where $U(c_t)$ is one period utility function, c_t is the level of consumption, δ is the rate of time preference, $\overline{A}_t$ is amount of land owned in time t, S_t is amount of saving in time t, $Y_t(\overline{A}_t)$ is the amount of income household i generates in time t, which itself is a function of the land owned by household *i* in that period (assume household self-cultivates all the land endowment). (3b) is a form of borrowing constraints, restricting the end stock of tradable assets to be nonnegative in each period.

As an analytical solution to this problem cannot be derived when income is stochastic (Zeldes 1986), the literature has resorted to simulation exercises to obtain solutions under general assumptions (Deaton 1991; Zeldes 1989, Rosenzweig and Wolpin, 1993; Carter and Zimmerman 2000). One key result from this literature is that supply of land to the sales market may be driven by distress sales. A second insight that is of relevance here is that the wealth bias may overwhelm the productivity advantage of small farmers and lead to land accumulation that takes little account of inherent productivity. The extent to which this will happen is an empirical question.

The fact that wealth effects may dominate in the land sales market but are likely to be of limited importance for land rental, provides the basis for a number of testable predictions. First, we expect that initial wealth is more important as a determinant of participation in sales than in rental markets. Second, even though we would expect households' ability to increase their market demand, the variable would be less important in sales markets. Finally, we expect a positive time trend in rental markets due to the fact that higher levels of off-farm activity, possibly together with lower transaction costs, make it more desirable for households to rent out their land.

DATA, DESCRIPTIVE STATISTICS, AND ESTIMATION STRATEGY

Data are from the 1999/2000 Uganda national household survey (UNHS) which covered 10,696 households, as well as the 1992/93 integrated household survey (IHS) covering 9,600 households.

Both are multi-purpose household surveys providing rich information on household characteristics, assets, and consumption. The agricultural module in the UNHS obtained data on asset and land holdings, including total area owned, cultivated, leased in, and leased out, both for the survey year (1999) and, through recall, for 1992[i]. This allows us to recover, for 7,324 UNHS households who had existed in 1992[ii], the amount of land bought or sold during the period, thereby avoiding the need to resort to information on whether the household *ever* purchased any land. In addition, pooling the two data sets allows us to make inferences on the extent to which rental markets have changed over time. Moreover, the fact that the UNHS contains a panel of about 1,300 households that had already been included in the IHS allows us to use a fixed effects production function in order to derive a measure of households' agricultural ability which can be included as an independent variable in the land market equations.

Household characteristics
Table 1 reports characteristics of the UNHS sample. With a mean education level of slightly below 5 years, 26% of the households were female headed and 12% widowed. About one fourth of the households had migrated to their present location before 1992 and an additional 15% did so after 1992. Non-farm activities were pursued by about one third. Over time, the value of household and agricultural assets owned had increased by between 30% and 40% even though the total value of assets owned is still low. The increase was greatest in percentage terms in the North although the very low basis implies that the value of household assets in the North still remained less than half of any of the other regions. The backwardness of the North extends to living conditions; while about 60% of households nation-wide have a roof with iron sheets, a share that is highest in the Center with 83%, only 15% do so in the North.

Table 1. Scriptive statistics.

Variable description	All Uganda	Central	East	North	West
Household characteristics					
Age of head (years)	43.32	42.62	43.47	43.01	44.1
Education of head (years)	4.91	5.37	5.00	4.30	4.71
Female head (%)	26.32	29.68	24.22	30.41	22.27
Non-widow (%)	14.34	17.59	12.84	17.15	10.62
Widow (%)	11.98	12.09	11.38	13.26	11.65
Migrated before 1992, (%)	26.14	34.05	23.39	20.48	23.91
Migrated after 1992 (%)	15.14	19.84	16.2	12.87	10.48
Non-farm activity (%)	34.06	38.39	35.25	28.91	31.45
Asset ownership					
Value of hh assets in 99 (US $)	281.56	346.96	247.7	113.18	348.89
Value of hh assets in 92 ($)	209.7	258.22	179.19	75.1	270.88
Value of agric assets in 99 ($)	103.58	85.88	109.28	110.65	112.47
Value of agric assets in 92 ($)	71.41	54.94	71.16	93.54	75.57
Iron sheet roof (%)	61.54	83.05	53.58	15.21	75.03
Land market participation					
Cost of renting in (US $)[1]	14.82	12.83	11.74	11.74	16.3
Profit per acre ($)	49.44	46.39	82.58	22.92	38.04
Price of land per acre - rural, 99 ($)	1,098.40	1,270.49	982.6	70.81	1,051.55
Leased in 99 (%)	19.48	15.74	27.09	28.36	10.62
Leased in 92 (%)	8.92	7.2	10.3	17.87	3.88
Leased out 99 (%)	5.09	4.44	8.47	4.76	2.83
Leased out in 92 (%)	1.75	1.87	3.16	1.24	0.69
Length of contract in 99 (years)	4.3	6.25	3.47	5.48	4.34
Length of contract in 92 (years)	2.6	3.4	2.51	2.5	2.38
Share of hh purchased land (%)	34.63	50.12	30.89	2.62	43.98
Share of hh inherited land (%)	27.04	14.8	30.21	31.33	31.74
Share of hh received free land (%)	37.54	45.73	34.6	38.23	33.04
Observations	10,696	3,110	2,865	1,802	2,919

Source: Own analysis based on the 1999/2000 UNHS.
[1] Cost of renting and length of contract only for households who leased in land.

The bottom panel provides a sketch of the land market situation, both in terms of land access and land prices. We computed the return to fixed factors and management by the land owner per acre of land, denoted "profit" in the table, by subtracting the value of purchased inputs from the total output obtained from a plot.

Comparing this figure with households' self-assessed land values provides an indication of the extent to which land is "overvalued" in the sense of land prices being above the net present value of profits at the current rate of interest.[iii] Results from doing so illustrate that self-reported land values are only about 3 times annual profits in the North and about 12 times this figure in the East. They are more than 20 times the value of annual profits in the Center and the West, suggesting that, possibly because of the lack of equally attractive assets that could act as a store of wealth, speculative demand pushes land prices in these regions beyond what would be justified by the productive value of the land. This would make it more difficult for efficient agricultural producers, and in particular the poor, to access land through the purchase market, consistent with the fact that there is considerable outmigration from the Center and the West by households in search of "unoccupied" land.

Table 2. Land market participation for households which existed in 1992 and 1999.

	All Uganda	Center	East	North	West
			1999		
Total area owned (cultivable; acres)	4.20	5.11	4.06	4.11	3.63
Total area cultivated (acres)	2.29	2.59	2.45	1.58	2.30
purchased (%)	27.55	40.74	23.19	2.65	34.39
received free (%)	41.09	42.51	37.16	62.37	31.33
inherited (%)	23.96	12.22	26.65	32.96	26.30
rented (%)	7.41	4.53	12.99	2.01	7.98
Share of households renting in (%)	35.91	36.20	43.42	35.17	29.61
paid rent	14.45	5.50	24.80	5.58	17.64
free	21.46	30.70	18.62	29.59	11.97
Rental price per acre ($)	10.14	4.34	10.65	11.01	14.32
Mean area rented (acres)	0.49	0.36	0.77	0.71	0.24
Share of households renting out (%)	8.90	10.67	12.86	6.22	5.54
Landless (%)	10.01	6.37	11.99	23.84	3.61
	All Uganda	**Center**	**East**	**North**	**West**
			1992		
Total area owned (cultivable; acres)	3.43	4.24	3.26	3.58	2.84
Total area cultivated (acres)	1.99	2.18	2.03	2.08	1.76
purchased (%)	28.59	41.90	24.45	2.80	34.83
received free (%)	39.77	40.98	35.22	61.85	30.95
inherited (%)	24.44	12.57	27.55	33.52	26.74
rented (%)	7.20	4.54	12.78	1.82	7.48
Share of households renting in (%)	12.58	13.23	13.57	19.78	7.22
paid rent	3.43	1.25	6.63	1.44	3.52
free	9.15	11.98	6.94	18.34	3.70
Rental price per acre - ($)	7.80	7.06	6.61	3.51	14.43
Mean area rented (acres)	0.30	0.29	0.34	0.58	0.13
Share of households renting out (%)	2.32	2.35	4.41	1.76	0.89
Landless (%)	27.46	22.16	29.54	38.28	23.98
	All Uganda	**Center**	**East**	**North**	**West**
			Between 1992 and 1999		
Share of hhs who purchased land (%)	11.86	16.35	12.07	1.06	13.08
Price of land per acre ($)	864.77	848.62	611.94	44.24	1,100.24
Share of hhs who inherited land (%)	5.43	3.75	6.21	6.70	5.60
Share of hhs who received land free (%)	14.10	21.31	15.03	12.57	8.09
Observations[1]	7,324	1,837	1,960	1,254	2,273

Source: data analysis by author based on 1999/2000 UNHS survey.
[1] Calculated for households that existed in 1992 based on recall.

The fact that almost two thirds of the transactions in rental markets in 1999 did not involve compensation (table 2) and that even in the cases where money is involved, rental rates are significantly less than one third of profits suggests that there is little spill-over from such speculative demand for land on rental markets. This is supported by the fact that activity in the land rental market has increased significantly over time, both on the demand and on the supply side.
The share of producers who were leasing in land increased from 9% in 1992 to 19% in 1999 and the share of those leasing out from about 2% to 5%. Levels of rental market activity are particularly high in the North and the East.

We also note that, concerning households' modality of land access, free receipt of land continues to be, with 37% in the overall sample, the most common way of land acquisition, followed by purchase (34%) and inheritance (27%). These national aggregates hide considerable regional variation; for example the share of those who purchased land ranges from virtually zero in the North (2.6%) to 50% in the Center. Also, the fact that, at some point in the past somebody had acquired land through the purchase market, is useful only if other initial conditions can be recovered and if social and economic conditions have not changed significantly in the interim. Even if this is the case, it is not possible to compare the 35% who had purchased land at some point to those who are currently renting and, on this basis, conclude that land sales markets are more active than rental markets. Instead, doing so requires to choose a cut-off point in time.

Land market participation
Patterns of land market participation for households who had existed in 1992 are illustrated in table 2, based on recall data gathered in 1999[iv]. The top and middle panels provide information on land ownership and rental market participation in 1999 and 1992, respectively, while the bottom panel provides information on participation in land sales markets between the two periods.

We note that, as a consequence of purchases, gifts, and inheritances, the endowments of land owned have increased significantly, from 3.4 to 4.2 acres on the average. More interestingly, activity in the land rental markets has increased significantly; while only about 13% of households were engaged in land rental in 1992, 36% were doing so in 1999. Although there has been a decline from 75% to about 60% in the share of those who rented in land for free, the absolute number of households who were able to complement their own endowment with land that was given to them without payment has more than doubled, from 9% to 21% of the sample, This illustrates not only that land rental can have a substantial welfare impact but also confirms the notion that barriers to land rental continue to be very low. Indeed, the share of households who rent out land increased from 2% to 9%. It appears that some households who buy land for speculative purposes as a store of wealth rent it out for free to their neighbours or relatives.

The bottom panel illustrates that, even though table 1 indicates that 35% of households had, at some point in their lives, purchased land, only about 12% of households had done so over the entire 7-year interval covered. On average, therefore, about 1.7% of households participate in land purchase markets every year. Comparing this with the 36% who were engaged in some rental in 1999 (or even the 14% who rented for payment in the same period) suggests that land rental markets are significantly more active than land sales markets. The bottom panel also shows that the self-assessed land prices reported in table 1 are (with the exception of the West) somewhat higher than what had been realized in actual market transactions although the difference could be due to land quality differences as well.

Table 3. Characteristics of households who participated in land market transactions.

	All		Leased in		Leased out		Purchased	Inherited	Received free
	1999	1992	1999	1992	1999	1992	1992-99	1992-99	1992-99
Household characteristics									
Age of head (yrs)	45.04	46.24	41.08	42.86	49.47	53.86	40.32	37.57	39.17
Female headed (%)	25.24	25.82	26.89	32.63	21.94	19.35	18.51	22.06	26.94
of which widow (%)	13.22	13.94	11.88	13.97	14.10	12.90	7.32	12.55	12.43
of which non-widow (%)	12.02	11.88	15.01	18.66	7.83	6.45	11.19	9.51	14.51
Education of head (yrs)	4.42	4.35	4.43	4.00	4.84	4.84	5.32	4.97	4.69
Household assets in 92 ($)		228.28		165.55		322.30	288.58	180.73	167.05
Household assets in 99 ($)	274.11		240.03		337.19		413.61	263.66	229.42
Agric assets in 92 ($)	83.10	90.04	70.91	100.58	122.10	186.15	96.65	68.42	50.03
Agric assets in 99 ($)	120.02		104.54		160.78		160.65	124.02	84.42
Roof sheets (%)	57.21	57.63	53.74	47.01	63.68	66.67	73.95	52.43	53.61
Land ownership									
Owned area in 1992 (acres)	4.26	3.99	1.47	1.03	8.51	11.97	2.79	2.38	1.64
Owned area in 1999 (acres)	4.64		2.04	1.84	10.13	12.29	5.63	4.54	2.66
Cultivated in 1992 (acres)	2.35	1.99	1.05	1.02	3.15	3.96	1.54	1.28	1.29
Cultivated in 1999 (acres)	2.24		1.26	0.85	3.18	3.61	3.14	2.27	1.73
Crop profits per acre	49.44		47.89		79.72		43.60	45.48	36.86
No. of observations	8,137	7,324	3,031	1,002	702	186	956	494	1,440

To give a first indication of differences between households who enter the rental market either on the demand or the supply side, table 3 provides evidence on household characteristics as well as land ownership by households who had rented in, rented out, or purchased land in any of the periods. We note that households leasing in are younger[v] (41 years as compared to average of 45 years for the overall sample), have significantly lower levels of household assets than the average (US $ 240 as compared to US $ 274; 53 with iron roofs compared to 57%), and have significantly less land (2 as compared to 4.6 acres). By comparison, those leasing out are older (49 years), richer (US $ 337 of household assets and 63% with iron roofs), and more land abundant (10 acres). Households who purchased land were also younger (40 years) than the average but more educated (5.32 years) and less likely to be headed by a female (18%). The fact that they had significantly more assets (US $ 288 as compared to 228) suggests that wealth may have a role to play in land purchases. They differ significantly from those households who either received land for free or inherited it during the period. Of course, all of these need to be explored more in a multivariate framework.

Table 4. Determinants of land purchases in the 1992 to 1999 period.

	Cross section			Panel
	Purchased	**Inherited**	**Gift**	**Purchased**
Agricultural ability				0.006
				(0.68)
Age of head	-0.002***	-0.002***	-0.004***	-0.002***
	(9.76)	(9.08)	(11.45)	(4.42)
Education of head	0.003***	0.002**	0.003**	0.001
	(3.50)	(2.15)	(2.30)	(0.49)
Female head (non-widow)	-.015	-.009	-.008	-.036
	(1.50)	(1.19)	(0.61)	(1.60)
Female head (widow)	-0.033***	0.037***	0.016	-0.018
	(3.22)	(3.81)	(1.18)	(1.02)
Household size (log)	0.032***	-0.002	-0.016**	0.015
	(4.95)	(0.46)	(2.03)	(1.11)
Iron sheet roof	0.032***	0.005	0.002	0.051***
	(3.95)	(0.84)	(0.21)	(2.99)
Area owned '92 (log)	-0.045***	-0.007	-0.091***	-0.021
	(7.29)	(1.36)	(9.70)	(1.54)
Landless '92	-0.021**	0.015*	0.019	0.003
	(2.00)	(1.66)	(1.24)	(0.13)
Land dispersion at village level (log)	0.005			0.003
	(1.04)			(0.29)
Value of hh assets '92 (log)	0.007**	-0.003	-0.007*	-0.004
	(2.46)	(1.54)	(1.95)	(0.62)
Value of agric assets '92 (log)	0.007***	0.001	-0.007***	-0.002
	(3.47)	(0.69)	(2.58)	(0.46)
Migrated before 1992	0.019**	-0.036***	-0.002	0.019
	(2.33)	(5.68)	(0.16)	(1.17)
Migrated after 1992	0.171***	-0.014	0.050***	-0.034
	(9.75)	(1.43)	(2.67)	(0.58)
Urban area	-0.032***	-0.026***	0.010	-0.042
	(2.91)	(2.79)	(0.59)	(1.49)
Profits per acre less village mean	-0.00001	-0.000002	-0.000006	
	(0.93)	(0.31)	(0.43)	
East	-0.041***	0.028***	-0.082***	-0.034*
	(5.15)	(3.24)	(7.30)	(1.91)
North	-0.120***	0.024**	-0.093***	-0.098***
	(10.93)	(2.17)	(6.81)	(3.43)
	0.038***	-0.152***	-0.024	
	(4.62)	(14.31)	(1.43)	
	-1.567***	-0.076	-1.717*	
	(2.86)	(0.43)	(1.79)	
Observations	7,294	7,294	7,294	1,178
Pseudo R^2	0.14	0.08	0.14	0.11
Log likelihood	-3,101.21	-1,901.32	-3,843.06	-321.56

Absolute value of z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5. Determinants of participation in land lease markets in 1999.

Dependent Variable	Full sample		Panel only	
	Lease in	Lease out	Lease in	Lease out
Household's agricultural ability			0.053**	0.014
			(2.41)	(1.56)
Age of head	-0.004***	0.000*	-0.005***	0.001
	(8.96)	(1.83)	(4.38)	(1.44)
Education of head	-0.000	0.000	0.009*	-0.001
	(0.07)	(0.43)	(1.85)	(0.30)
Female head (non-widow)	-0.018	-0.013	-0.024	-0.039*
	(0.85)	(1.43)	(0.42)	(1.81)
Female head (widow)	-0.026	0.003	-0.034	-0.016
	(1.28)	(0.31)	(0.70)	(0.84)
Household size (log)	0.093***	-0.019***	0.117***	-0.013
	(6.39)	(3.07)	(3.32)	(0.94)
Iron sheet roof	0.002	0.018**	0.025	0.011
	(0.14)	(2.24)	(0.61)	(0.59)
Land dispersion at village level (log)	0.025**	-0.014***	0.014	-0.020
	(2.54)	(2.90)	(0.57)	(1.63)
Area owned (log)	-0.294***	0.074***	-0.297***	0.078***
	(23.89)	(17.54)	(9.33)	(7.12)
Value of hh assets (log)	0.019**	-0.004	0.013	-0.006
	(2.26)	(1.06)	(0.91)	(1.09)
Value of agric assets (log)	0.012***	-0.003	-0.019*	0.003
	(2.76)	(1.57)	(1.75)	(0.73)
Landless	0.608***		0.661***	
	(14.77)		(5.30)	
Migrated before 1992	0.029*	0.010	-0.028	0.018
	(1.89)	(1.51)	(0.76)	(1.13)
Migrated after 1992	0.095***	0.008	0.187	0.135
	(3.21)	(0.59)	(1.14)	(1.50)
Urban area	-0.072***	-0.005	-0.019	0.024
	(2.79)	(0.39)	(0.26)	(0.68)
Profits per acre less village mean	0.000	0.000		
	(0.95)	(0.92)		
East	0.043**	0.031***	0.043	0.018
	(2.29)	(3.65)	(0.92)	(0.93)
North	-0.095***	-0.028***	-0.173***	-0.034
	(3.74)	(2.86)	(2.67)	(1.62)
West	-0.079***	-0.037***	-0.037	-0.071***
	(4.73)	(4.99)	(0.88)	(4.15)
Observations	7,293	7,293	1,088	1,006
Pseudo R^2	0.265	0.122	0.262	0.185
Log likelihood ratio	-3,502.73	-1,922.68	-523.27	-247.15

Absolute value of z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Estimation strategy

To obtain an estimate of households' agricultural ability, we use the panel household to estimate a Cobb-Douglas production function with household fixed effects. Let technology be represented by the production function

$$Q_{ijt} = \exp(\alpha_i + \alpha_j) A_{ijt}^{\theta_1} L_{ijt}^{\theta_2} K_{ijt}^{\theta_3} \tag{1}$$

where Q_{ijt} is agricultural output produced by household i in village j in year t; A_{ijt}, L_{ijt} and K_{ijt} are the land, labor and capital used to produce this output Q, with technical coefficients θ_1, θ_2, and θ_3 and $\exp(\alpha_i + \alpha_j)$ is the efficiency parameter which consists of a household- and a village-specific element reflecting access to infrastructure and markets, soil quality, climate, etc.

Taking logs of both sides of equation (1) and adding a time trend and an iid error term, and letting $\alpha_{ij} = \alpha_i + \alpha_j$, we obtain an estimable equation for production by household i in village j at time t as follows.

$$q_{ijt} = \alpha_{ij} + \theta_1 a_{ijt} + \theta_2 l_{ijt} + \theta_3 k_{ijt} + \phi t + \varepsilon_{ijt} \qquad (2)$$

where lower case letters refer to the logarithm of the quantities referred to above. Availability of multiple observations per household in the panel allows us to estimate this equation using household fixed effects.

$$q_{ijt} - \overline{q}_{ij} = \alpha_{ij} - \overline{\alpha}_{ij} + \theta(Z_{ijt} - \overline{Z}_{ij}) + \phi(t - \overline{t}) + \varepsilon_{ijt} - \overline{\varepsilon}_{ij} \qquad (3)$$

where Z is a vector consisting of a, l, k and θ is a coefficient vector. For each producer, we will be able to recover the composite efficiency parameter α_{ij}, which will include other unobservable characteristics, many of which are village-specific. To eliminate these, we apply a similar procedure at the village level so as to obtain an estimate of α_j, the pure idiosyncratic effect for each producer in the sample.

To determine factors that caused households to participate in land purchase markets (or received land through either inheritance or as a gift) in the 1992 to 1999 period, we estimate probit and tobit regressions with a zero/one participation dummy and the log of the amount of land purchased as dependent variables, respectively. Right hand side variables include a vector of household characteristics and initial endowments, whether or not the household migrated, and for households where this information is available, agricultural ability. Formally,

$$P_i = \beta_0 + \beta_1 K_i + \beta_2 X_i + \beta_3 E_i + \beta_5 M_i + \varepsilon_i \qquad (4)$$

where P_i is either a dummy or the log of area purchased as described above K_i is agricultural ability, X_i is a vector of household characteristics including, age, sex, and the head's education, E_i is a vector of initial endowments including education, land area owned, and value of assets, and M_i is a vector of migration dummies, indicting whether the household migrated either before or after 1992 and ε_i is an error term assumed to be normally distributed with zero mean and constant variance.

While proper identification of the land purchase equation requires information on initial land endowments, participation in lease markets is decided at any given point in time. The estimating equation is therefore

$$L_i = \beta_0 + \beta_1 K_i + \beta_2 X_i + \beta_3 E_i + \beta_5 M_i + \eta_i \qquad (5)$$

where L_i is either a dummy for renting in (or renting out) land or the log of the area rented. Other variables are similar to what was discussed in equation (4), with the only difference being that E_i includes only contemporaneous land ownership.

For the pooled 1999 and 1992 sample, we estimate a model with a time interactive dummy for land owned, value of household and agricultural assets where we have observations for 1999 and 1992, and a pure trend of the form;

$$C_{it} = \beta_0 + \beta_1 X_{it} + \beta_1 E_{it} + \beta_3 M_{it} + \delta_1 E_{it} T + \delta_2 R_{it} T + \alpha_3 T + \mu_{it} \qquad (6)$$

where the dependent variable, C_{it} is a categorical variable for leasing in or leasing out land, X_i is a vector of household characteristics and E_{it} is a vector of endowments that includes education, land area owned, and value of assets, M_{it} is dummy for migration, μ_{it} is an iid error term, and T is a year dummy to capture the time trend in rental markets. To explore whether the relevance of certain endowment variables has shifted over time, we add an interaction between the time trend and endowment variables $E_{it} T$.

RESULTS AND IMPLICATIONS

The fact that information is available on different modalities of land access allows us to identify determinants of households' land access and compare these to variables that increase the probability of accessing land through the rental market at any point in time.

Incidence and impact of land sales markets

We limit our discussion to the results from probit regressions for land participation; tobit models using the amount of area transferred as dependent variable are consistent with this evidence and therefore relegated to the annex. We find that, in line with our prediction, younger households with higher levels of education are more likely to purchase land, suggesting that land sales market participation is partly a life cycle phenomenon. Also, large households are more likely to have the labor force necessary and are thus, ceteris paribus, more likely to purchase land. Even considering these factors, female headed households, in particular widows, seem to be discriminated against in the land purchase markets; being a widow reduces the probability of having purchased land by 3.3%.

Table 6. Determinants of rental market participation: Pooled 1992/1999 sample.

Dependent Variable	1992 & 1999 pooled sample		Panel households	
	Lease in	Lease out	Lease in	Lease out
Age of head	-0.002***	0.000***	-0.003***	0.000*
	(8.73)	(3.79)	(6.31)	(1.79)
Education of head	-0.005***	-0.000	-0.006**	-0.000
	(5.17)	(0.71)	(2.51)	(0.71)
Female head (non-widow)	0.024**	-0.004	0.010	-0.010
	(2.53)	(1.17)	(0.42)	(1.35)
Female head (widow)	0.011	0.004	-0.013	-0.005
	(1.12)	(1.04)	(0.64)	(0.83)
Area owned (log)	-0.141***	0.035***	-0.181***	0.039***
	(29.14)	(20.74)	(16.32)	(10.44)
Year*area owned	0.001*	-0.000**	0.002**	-0.000**
	(1.77)	(2.29)	(2.00)	(2.17)
Value of hh assets (log)	0.019***	-0.001	0.018*	-0.001
	(4.43)	(0.42)	(1.76)	(0.28)
Year*hh asset value	-0.014**	0.000	-0.001	-0.003
	(2.54)	(0.11)	(0.07)	(0.78)
Value of agric assets (ϕ_1)	0.010***	-0.000	0.001	-0.001
	(3.25)	(0.10)	(0.12)	(0.23)
Year*agric asset value (ϕ_2)	0.019***	-0.001	0.019**	0.001
	(5.02)	(0.60)	(2.10)	(0.37)
Land dispersion at village level	-0.000	-0.000**	0.001	-0.001*
	(0.30)	(2.17)	(0.57)	(1.93)
Year*land dispersion	-0.000	0.000	-0.004	0.001
	(0.68)	(1.46)	(1.24)	(1.29)
Migrated	-0.002	0.001	0.010	0.027***
	(0.17)	(0.30)	(0.41)	(2.64)
Urban area	-0.123***	-0.007*	-0.092***	0.003
	(14.47)	(1.74)	(4.24)	(0.36)
East	-0.015	0.007	-0.032	0.005
	(1.05)	(1.23)	(1.02)	(0.51)
North	0.067***	-0.020***	0.065	-0.034***
	(3.75)	(3.41)	(1.59)	(2.84)
West	-0.100***	-0.022***	-0.104***	-0.030***
	(7.25)	(4.07)	(3.44)	(3.13)
Year	0.161***	0.032***	0.142**	0.044*
	(5.75)	(2.79)	(2.02)	(1.81)
East*year	0.080***	0.004	0.068	0.001
	(4.13)	(0.56)	(1.56)	(0.08)
North*year	-0.042**	0.009	-0.074*	0.086*
	(2.15)	(0.85)	(1.68)	(1.78)
West*year	0.123***	0.006	0.112**	0.009
	(6.01)	(0.77)	(2.48)	(0.54)
Observations	16,200	16,200	3,151	3,151
Pseudo R^2	0.136	0.171	0.163	0.204
Log likelihood ratio	-7,347.07	-2,711.81	-1,432.33	-538.19

Absolute value of z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

The regression also suggests that, in addition to human capital assets, some initial wealth is needed in order to enter the land purchase market; those who did so had both higher levels of household and agricultural assets in 1992, and were more likely to have an iron roof. Migration, especially after 1992, does have a significant and very positive impact, suggesting that migration with subsequent land purchase may be part of a broader strategy employed by younger households in Uganda that may be worth exploring further. Consistent with the need for some wealth in terms of physical or human capital, we find that it is significantly more difficult for the landless to acquire land through purchase markets. Once these factors are taken into account, land sales markets do not seem to lead to land concentration; in fact the regression suggests that households who had lower land endowments in 1992 were more likely to subsequently acquire land through the land purchase market. The neutral or even slightly redistributive effect of land sales markets is confirmed by the fact that the Gini coefficient for the land ownership distribution was 0.55 in 1992 and in 1999, i.e. there was no concentration in land ownership between the two periods.

At the same time, the dispersion of land ownership at the village level did not have a noticeable impact, suggesting that equalization of land endowments is not one of the major forces driving land sales markets. We note that land purchase markets are most active in the Center, followed by the West and the East, and least active in the North where inheritance and gifts are more important. Comparing this to other modalities of land acquisition during the same period illustrates that free gifts have a more redistributive element than land purchase markets and that widows are more likely to receive land through inheritance.

Our measure of agricultural ability can be constructed only for the 1,178 households included in the panel, and including it in the regression suggests that land sales markets do not transfer land to more productive producers. While the smaller sample size implies that not all of the coefficients turn out significant, the signs are consistent with those obtained in the large sample and coefficients on age and wealth remain significant. The conclusion of land purchase markets not transferring resources to more productive producers is supported by the fact that an alternative measure of agricultural ability, i.e. the deviation of profits per acre obtained by any specific producer from the village mean, is insignificant as well.

Incidence and impact of land rental markets
Contrary to the case of land purchase markets where truncation of the sample implied that we could use only the demand side of the market, reliable rental market information is available for those renting in as well as renting out. In our discussion, we focus on differences to land sales markets and the extent to which these correspond to what would be predicted by theory. Tobit estimates of the area transacted have been relegated to an appendix as the substantive conclusions emerging from them are very similar.

Both the coefficients on age and on household size are larger than in the land sales equation, suggesting that rental markets are more effective than sales markets in transferring land to young and more populous households, thus providing an opportunity to employ relatively abundant family labor. This is reinforced by the large coefficient on the landless dummy, which suggests that it is much easier for landless households to gain access to land through rental markets. Their probability of doing so is, with 60%, 4 times as high as in the sales market. Contrary to what was observed in sales markets, there is no discrimination against widows. We also note that the coefficient on area owned is highly significant and negative, implying that land rental markets transfer land towards those with limited endowments and do so much more than is accomplished through land sales. Finally, and in line with the above, the coefficient on land dispersion in the village is very positive and significant at the 5% level implying that rental markets (in contrast to sales markets) are more active in locations where, other things equal, there is greater scope for productivity gains from equalizing endowments across producers.

Concerning initial wealth, we note that the coefficient on the main indicator of higher wealth, having an iron roof, is insignificant. Together with the fact that education is insignificant, this suggests that entry requirements to rental markets are lower than for sales markets. The fact that coefficients on household and agricultural assets are significant, though not significantly different from those in the purchase equation, indicates that some assets will still be required to facilitate making good use of the land acquired. Even though the regression suggests that migrants are more likely to rely on land rental markets to gain access to land than those who did no migrate, the size of the coefficient is smaller than for land purchase markets. This suggests that, even though rental is one option through which migrants can access land, the preferable option is purchase and it is not desirable for migrants to establish themselves in a place solely based on land rental.

Shifting from the whole sample to the panel households for whom information on agricultural ability is available we note that more productive producers are more likely to make use of land rental markets. Compared to the least productive producer in the sample, the most productive one has a 40% higher probability of accessing land through the rental market, a percentage increase that is clearly large enough to overturn any wealth effect (note that the mean of the log of agricultural and household assets is less than 10 in each case). More interestingly, we note that agricultural ability may have been correlated with asset ownership as can be seen from the fact that the coefficient on household assets now turns insignificant and the one on agricultural assets negative and significant at the 10% level.[vi]

Turning to the supply side, we note that many of the coefficients are indeed opposite from those observed for demand. For example, age increases and household size decreases the propensity of supplying land to the rental market, in line with theoretical predications. We find that agricultural ability seems to have little impact on supply of land to rental markets. Also, it is not clear how to explain the negative coefficient of the dispersion of land ownership at the village level. At the same time, land is supplied to the rental market by households who own larger amounts of land and are wealthier (as indicated by them having an iron roof).

Evolution of land rental market activity
The results based on the pooled sample reinforce what had been found earlier regarding the significant increase of land rental markets activity over time as the general economy picked up as well as their redistributive effect. Most important is the increase in the level of rental market activities; the regression indicates that the probability of participating in land rental markets in 1999 is 16% higher than it was in 1992. Concerning static effects, the combined sample also suggests that rental markets transfer land to less educated people and that female headed households may even have an advantage in gaining access to land through such markets.

As regards changes over time, we find that the importance of household assets has declined; in fact we can no longer reject the hypothesis that in 1999 possession of non-agricultural household assets no longer affect the probability of participating in land rental markets. At the same time, agricultural assets still matter significantly and their importance has increased over time. We take this as an indication that land rental markets have, over time, shifted land to more productive producers.

CONCLUSION AND POLICY IMPLICATIONS

We started this paper by noting that the empirical literature on land issues in Africa has been characterized by a failure to distinguish between rental and sales markets as well as an over-emphasis on titling. Our analysis highlights that failure to distinguish the two is a critical shortcoming that will affect the ability to form a solid opinion on the scope as well as the actual contribution of land markets to contribute to improved productivity and development of the non-farm sector.

We find that, for the case of Uganda, land rental markets make an important contribution to improved productivity in a pro-poor way that helps to provide land access to those in need, especially households who do not own any land. In line with theory, which would predict the scope for land market transactions to increase with overall economic development, we find that the level of land market participation has indeed increased considerably over time, with some evidence that wealth constraints have become less important.

Even though ability does not emerge as a significant determinant of land sales demand and land prices are beyond what would be justified based on the present value of agricultural profits in some regions, we fail to find any evidence for concentration of land through sales markets, in line with what was found in other studies (Baland et al. 2001).

There are a number of areas for further research emerging from our analysis. In view of the very low entry barriers to rental, exploring in more detail the extent to which rental can, in the Ugandan context, provide a first step towards accumulation of human and physical capital that can eventually facilitate the acquisition of land through the sales market would be of great interest. It would also be of interest to assess the extent to which land rental, even in cases where it covers relatively long time periods, may be associated with investment disincentives. Finally, it would be worth quantifying in more detail the productivity impact brought about by land rentals so as to illustrate their contribution to overall economic growth.

From a policy perspective, our results do not provide any justification for the imposition of restrictions on the functioning of land markets. In fact, the finding that ill-functioning land markets were one of the root causes of conflict in Rwanda (Abraham and Platteau 1998) suggests that establishing a regulatory framework within which such markets can operate is critical for reasons that go far beyond productive efficiency. In countries where, because of historical intervention by colonial powers, rental markets are un- or underdeveloped, governments have aimed to correct the mal-distribution of assets brought about by such intervention through redistributive land reform and often implicitly or explicitly restrict the scope for land rental in ways very similar to Asian tenancy restrictions. Our results suggest that, even in a situation where there is relatively egalitarian access to land, land rental markets will have a key role in ensuring effective use of a country's land resources, in parallel to what has been found in China (Deininger and Jin, 2002). They also point towards increased importance of such markets with overall economic development.

While we are fairly confident that similar results would be found for countries with a relatively egalitarian land ownership distribution such as Ethiopia, it would be of interest to explore the extent to which our results carry over to African countries where the underlying distribution of land ownership is less egalitarian than in Uganda. To the extent that they do, two implications would be immediate. First, countries that restrict the functioning of land rental markets might have to think about ways of eliminating such restrictions. Second, even where land reform, as a means to bring about changes in the land ownership distribution, is considered to be necessary, the measures taken to bring about such a reform should not undermine the functioning of rental markets. To the extent that rental markets all over the world seem to shift land to farmers with high agricultural ability, it would be important to design mechanisms of land redistribution that complement land rental markets, rather than trying to substitute for them.

ACKNOWLEDGEMENTS

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ANNEX

Table 1. Production function for panel households.

Dependent Variable	OLS	Random effects model	Fixed effects model
Education of head	-0.007	-0.007	0.013
	(1.03)	(0.99)	(0.81)
Age of head	-0.000	-0.000	0.004
	(0.26)	(0.12)	(0.91)
Female head (non-widow)	-0.159**	-0.165**	-0.151
	(2.22)	(2.22)	(0.90)
Female head (widow)	-0.117	-0.126*	-0.181
	(1.61)	(1.68)	(1.14)
Iron sheet roof	-0.064	-0.068	0.029
	(1.22)	(1.26)	(0.31)
Age group 6-14 years (log)	0.057	0.072*	0.107*
	(1.38)	(1.74)	(1.79)
Age group 15-64 years (log)	0.077	0.086	0.116
	(1.24)	(1.36)	(1.23)
Labour cost (log)	0.056***	0.057***	0.054**
	(3.00)	(3.05)	(2.19)
Input costs (log)	0.631***	0.614***	0.434***
	(23.23)	(22.67)	(11.63)
Uses manure	-0.300***	-0.259**	0.047
	(2.76)	(2.41)	(0.34)
Uses pesticides	-0.115	-0.123	-0.045
	(0.89)	(0.97)	(0.28)
Value of hh assets (log)	0.085***	0.085***	0.073***
	(5.78)	(5.82)	(3.28)
Value of agric assets (log)	0.067***	0.068***	0.068***
	(4.24)	(4.37)	(3.23)
Area cultivated in (log)	0.496***	0.479***	0.321***
	(11.32)	(10.96)	(5.40)
Urban area	-1.006***	-1.060***	0.888
	(12.98)	(12.95)	(0.90)
Year	-1.145***	-1.128***	-0.767***
	(13.14)	(13.22)	(6.43)
Constant	2.002***	2.009***	1.800***
	(17.50)	(16.99)	(6.07)
Observations	2,365	2,365	2,365
R^2	0.53		0.42
Number of panel hhs		1,265	1,265
Hausman test for difference in coefficients (H_0: RE is more efficient)			
Chi^2		147.33	
$Prob > Chi^2$		0.000	

Absolute value of t statistics in parentheses
significant at 10%; ** significant at 5%; *** significant at 1%

Table 2. Land area acquired between 1992 and 1999.

| | Cross-section | | | Panel |
	Purchased	Inherited	Received free	Purchased:
Household's agricultural ability				0.123
				(0.62)
Age of head	-0.055***	-0.069***	-0.039***	-0.049***
	(9.53)	(8.31)	(11.63)	(3.85)
Education of head	0.076***	0.075***	0.038***	0.032
	(3.73)	(2.62)	(2.82)	(0.69)
Female head (non-widow)	-0.107	-0.184	-0.039	-0.336
	(1.23)	(1.24)	(0.68)	(1.18)
Female head (widow)	-0.304***	0.533***	0.079	-0.048
	(3.13)	(3.74)	(1.30)	(0.20)
Household size (log)	0.712***	-0.023	-0.153*	0.347
	(4.87)	(0.12)	(1.88)	(1.12)
Iron sheet roof	0.642***	0.290	0.038	1.101***
	(3.54)	(1.18)	(0.34)	(2.70)
Area owned '92 (log)	-0.665***	-0.117	-0.666***	-0.269
	(4.94)	(0.60)	(7.11)	(0.91)
Landless '92	-0.147	0.837**	0.457***	0.141
	(0.62)	(2.46)	(2.99)	(0.25)
Land dispersion at village level (log)	0.185*			0.154
	(1.67)			(0.61)
Value of hh assets '92 (log)	0.183***	-0.112	-0.035	-0.057
	(2.94)	(1.40)	(0.94)	(0.44)
Value of agric assets '92 (log)	0.173***	0.056	-0.026	-0.067
	(3.91)	(0.93)	(0.93)	(0.62)
Migrated before 1992	0.408**	-1.578***	0.006	0.581
	(2.39)	(5.57)	(0.05)	(1.63)
Migrated after 1992	2.472***	-0.444	0.388**	-0.946
	(9.58)	(1.10)	(2.29)	(0.55)
Urban area	-0.831***	-1.227***	-0.026	-1.536*
	(3.00)	(2.74)	(0.16)	(1.84)
Profits per acre less village mean	-0.000	-0.000103	-0.000044	
	(1.19)	(0.38)	(0.37)	
East	-0.844***	1.015***	-0.617***	-0.958**
	(4.37)	(3.34)	(5.05)	(2.12)
North	-4.410***	0.814**	-0.713***	-3.973***
	(10.41)	(2.16)	(4.49)	(3.39)
West	-0.691***	1.102***	-1.549***	-0.649*
	(3.94)	(3.83)	(12.27)	(1.68)
Constant	-3.941***	-4.902***	0.593**	-2.005*
	(8.63)	(7.72)	(2.18)	(1.88)
Observations	7,294	7,294	7,294	1,178
Pseudo R2	0.08	0.05	0.08	0.07
Log likelihood ratio	-2,983.27	-2,089.65	-3,589.33	-400.56

Absolute value of t statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 3. Area leased in/out – 1999 data.

Dependent Variable	1999		Panel data	
	Leased in (log)	Leased out (log)	Leased in (log)	Leased out (log)
Profits per acre less village mean	0.000*	0.000		
	(1.90)	(0.51)		
Household's agricultural ability			0.105***	0.185
			(3.17)	(1.54)
Age of head	-0.007***	0.005**	-0.008***	0.011*
	(9.25)	(2.39)	(4.47)	(1.68)
Education of head	0.001	0.003	0.017**	-0.006
	(0.32)	(0.28)	(2.22)	(0.21)
Female head (non-widow)	-0.039	-0.152	0.009	-0.702*
	(1.15)	(1.35)	(0.11)	(1.75)
Female head (widow)	-0.032	0.016	-0.087	-0.244
	(0.95)	(0.17)	(1.18)	(0.89)
Household size (log)	0.183***	-0.191***	0.177***	-0.197
	(7.56)	(2.83)	(3.46)	(1.06)
Iron sheet roof	-0.030	0.181**	0.027	0.166
	(1.04)	(2.01)	(0.44)	(0.67)
Land dispersion at village level (log)	0.030*	-0.136***	0.024	-0.301*
	(1.90)	(2.61)	(0.65)	(1.82)
Area owned (log)	-0.472***	0.939***	-0.412***	1.252***
	(22.06)	(17.92)	(8.48)	(7.63)
Value of hh assets (log)	0.035***	-0.051	0.030	-0.095
	(2.60)	(1.23)	(1.46)	(1.20)
Value of agric assets (log)	0.038***	-0.035	-0.018	0.040
	(5.18)	(1.61)	(1.18)	(0.71)
Landless	0.687***		0.754***	
	(16.72)		(7.42)	
Migrated before 1992	0.045*	0.072	-0.095*	0.196
	(1.77)	(0.97)	(1.71)	(0.94)
Migrated after 1992	0.087**	0.037	0.041	0.861
	(1.96)	(0.25)	(0.21)	(1.27)
Urban area	-0.163***	-0.026	0.009	0.412
	(3.90)	(0.20)	(0.08)	(0.99)
East	0.111***	0.398***	0.070	0.366
	(3.63)	(4.61)	(1.02)	(1.53)
North	-0.044	-0.317**	-0.141	-0.641*
	(1.04)	(2.52)	(1.41)	(1.80)
West	-0.160***	-0.437***	-0.090	-1.225***
	(5.44)	(4.83)	(1.39)	(4.24)
Constant	-0.332**	-3.182***	0.420	-3.372***
	(2.35)	(7.69)	(1.51)	(3.05)
Observations	7,293	7,293	1,088	1,088
Pseudo R^2	0.198	0.122	0.212	0.200
Log likelihood ratio	-49,80.73	-2,385.03	-693.05	-319.26

Absolute value of t statistics in parentheses
significant at 10%; ** significant at 5%; *** significant at 1%

Notes:

[i] The fact that this module was applied only to households who are currently engaged in crop production implies that supply of land in both the land rental and sales market are likely to be truncated. As there are many households who still own considerable amounts of land in urban areas, this may be a problem. We desist from estimation of the supply side of the sales market.

[ii] From the 1999 survey, we define a household to have been in existence in 1992 if the responses with respect to source of water and firewood indicate that it drew water or fetched firewood from the same source. In addition, the household must have had positive assets in 1992.

[iii] Note that, because there was no "market test" could imply that households may overvalue their land, a hypothesis that is indeed supported by the fact that the prices recorded in actual purchase transactions in table 2 are about 20% lower than the self-assessed ones described in table 1, although the North and the West are notable exceptions. While an in-

depth investigation of the differences between subjective land values and actual market prices would transcend the scope of this paper, the general point of overvaluation of land in the West and the Center is valid even without such a detailed investigation.

[iv] For panel households, we can compare the information they reported in the 1992 IHS with the recall data available from the 1999/2000 UNHS on selected variables in order to assess data quality. Doing so for the case of land owned in 1992 reveals that, for almost 75% of the sample, the information matches exactly, pointing towards very high data quality.

[v] As defined by the age of the household head.

[vi] The fact that a similar productivity impact cannot be verified if we use the deviation of a producers per acre profits from the village mean suggests that the latter may not be an ideal measure for agricultural ability.