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Smallholder Income and Land Distribution in Africa: Implications for Poverty Reduction Strategies

by

T.S. Jayne, Takashi Yamano, Michael Weber, David Tschirley, Rui Benfica, David Neven, Anthony Chapoto, and Ballard Zulu

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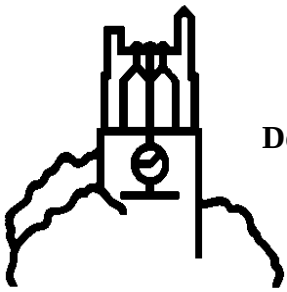

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SMALLHOLDER INCOME AND LAND DISTRIBUTION IN AFRICA: IMPLICATIONS FOR POVERTY REDUCTION STRATEGIES

by

T.S. Jayne, Takashi Yamano, Michael Weber, David Tschirley, Rui Benfica, David Neven, Anthony Chapoto, and Ballard Zulu

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EXECUTIVE SUMMARY

This paper provides a micro-level foundation for discussions of income and asset allocation within the smallholder sector in Eastern and Southern Africa, and explores the implications of these findings for rural growth and poverty alleviation strategies in the region. Results are drawn from nationally-representative household surveys in five countries between 1990 and 2000: Ethiopia, Kenya, Rwanda, Mozambique, and Zambia.

The paper addresses five major points: (1) why geographically-based poverty reduction or targeting strategies—e.g., focusing on marginal areas—is likely to miss a significant share of the poor in any particular country regardless of targeting efficiency in these areas; (2) why current enthusiasm for community-driven development approaches will require serious attention to how resources are allocated at local levels; (3) why sustained income growth for the poorest strata of the rural population will depend on agricultural growth in most countries, even though the poor generally lack the land and other productive resources to respond directly or immediately to policies and investments to stimulate agricultural growth; (4) why agricultural productivity growth, while most easily generating gains for better-off smallholder farmers, is likely to offer the best potential for pulling the poorest and land-constrained households out of poverty; and (5) why meaningful poverty alleviation strategies in many countries will require fundamental changes to make land more accessible to smallholder farmers. This could be accomplished through various processes, including improvement in land rental markets or perhaps land redistribution. We briefly elaborate on each of these findings.

Why geographically-based poverty reduction or targeting strategies is likely to miss a significant share of the poor in any particular country: While there are some areas that tend to experience higher rates of poverty than other areas, the findings from these five countries—Ethiopia, Kenya, Mozambique, Rwanda, and Zambia—suggest that poverty among smallholder households is not primarily a geographic phenomenon. Most of the variations in smallholder incomes tend to be within-village rather than between village, or in other words, the poor are geographically scattered throughout all regions of a country. This has implications for targeting vulnerable groups. Targeting of vulnerable, resource poor households requires greater emphasis on intra-community targeting, as a complement to regional targeting. This makes targeting more challenging and costly to avoid private trading disincentives, if the development of private sector-led input and food marketing systems is considered to be an objective of government policy. On the positive side, the fact that poor as well as relatively better-off smallholder farmers are located in the same areas is good news for generating multiplier effects from agricultural growth.

Why current enthusiasm for community-driven development approaches will require serious attention to how resources are allocated at local levels: We find across all five countries serious disparities in incomes and land allocation at the local level. This may give pause to current development initiatives focusing on “community-driven development.” While it is possible that village-level disparities in incomes and land could naturally occur as an outgrowth of differences in capabilities and entrepreneurship across households, it is at the very least important to ask

whether local or national governance decisions over time play a role in generating such disparities. The data presented here is unable to provide a clear answer to this question. However, the findings do emphasize the need for promoting greater transparency and equity in village-level resource allocation decisions if there is to be a serious attempt to combat rural poverty. This conclusion flows from the strong association between landholding size and per capita incomes, especially at low levels of landholding size. Over time, it is possible that broad-based economic growth coupled with education can help pull landless and near-landless households into more remunerative non-farm activities, lessening the importance of access to land as a dominant determinant of income levels.

Why meaningful poverty alleviation strategies in many countries will require fundamental changes to make land more accessible to smallholder farmers: The results in this paper highlight a major structural problem within smallholder agriculture in these African countries. Structural transformation requires broad-based income rural growth, and broad-based rural income growth is facilitated by relatively egalitarian distribution of rural assets (Gugerty and Timmer 1999). But around 50% of the rural small farm population cultivates less than 0.15 hectares per capita in densely populated countries such as Rwanda and Ethiopia, and less than 0.3 hectares per capita in supposedly land-abundant countries such as Zambia and Mozambique. Therefore, absent major changes in access to land the following processes in these countries are likely to continue: (1) farm sizes are likely to decline over time; (2) landlessness and near-landlessness will emerge as increasingly important social and economic problems unless growth in the non-farm sectors can be substantially increased; and (3) given existing agricultural technology and realistic projections of future productivity growth potential, large segments of the rural population will be unable to climb out of poverty through agricultural growth on their own farms.

These findings reinforce the idea that where access to land is highly concentrated and where a sizable part of the rural population lack sufficient land to earn a livelihood, then special measures will be necessary to tackle the problem of persistent poverty. This is almost certain to be a long term undertaking, but avoiding the issue will only prolong the problem.

What are the implications of recent empirical results—indicating a negative relationship between the concentration of rural assets and the poverty-reducing effects of economic growth—in the context of the findings presented in this paper about land allocation? It may be necessary to ask whether structural transformation processes may be retarded in situations in which the distribution of rural assets are so highly skewed that a large strata of the rural population may be unable to benefit from agricultural growth incentives that would otherwise generate broad-based growth multipliers. In some African countries, the distribution of land and other productive assets appears to be more skewed than available estimates for Asia at the time of the green revolution as well as most of South America. Education, which played a role in much of Asia by allowing households to exit agriculture into more lucrative off-farm jobs, is relatively low in most areas of rural Africa by world standards. Improving access to key assets, such as land and education, appears to be necessary to translate agricultural growth incentives into broad based structural transformation. We present this last issue as admittedly conjectural at this stage, but worthy of further research attention.

Why sustained income growth for the poorest strata of the rural population will depend on agricultural growth in most countries, and why agricultural productivity growth, while most easily generating gains for better-off smallholder farmers, is likely to offer the best potential for pulling the poorest and land-constrained households out of poverty: Economic growth is clearly a necessary condition to attack the problem of widespread poverty associated with near-landlessness observed in these countries. Safety nets and targeted programs will also continue to be important means of addressing poverty and vulnerability, but these measures in themselves are not geared to address the root causes of poverty, which are related to the generally low level of agricultural productivity. Sustained income growth for the poorest segment of the rural population is likely to depend on agricultural growth in most countries. The literature on growth linkages indicates that the first-round beneficiaries of agricultural growth generate important multiplier effects by increasing their expenditures on a range of local off-farm and non-farm activities that create second-round benefits for a wide-range of other households in the rural economy. Income growth derived from agricultural productivity growth generates demand for non-farm activities that has absorbed the rural poor into more viable non-farm activities. In much of Africa, the consumption growth linkages have been found to be especially important (Delgado and Minot 2000). The extent and magnitude of these second round effects depend on a number of factors, including education, infrastructure, and institutional development, but importantly include whether the income stimulus is widely spread (Delgado and Minot 2000; Fan and Hazell 1999). The initial distribution of land and other productive assets, which clearly influences how broad-based the first round beneficiaries of agricultural growth will be.

While sizeable segments of the smallholder populations do not have enough land assets to respond to "smallholder commercial agriculture" opportunities, the data suggest that there are smallholders with relatively more land and related assets, who probably can respond, and who are located in many of same villages as those who have relatively little land on a household per capita basis. This finding holds powerful implications for policy if shown to be widespread, as suggested by the data. Dynamic labor and services markets, and other employment opportunities should be easier to create (other factors constant) in the very locations where some smallholders are investing and raising their output and productivity. Pro-active public sector investment and policy support in developing these labor and service markets will be a key determinant of the magnitude of the growth linkages to be derived from agricultural growth.

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1. BACKGROUND

The foundation for almost all research on development in Sub-Saharan Africa is a solid empirical understanding of the structure and causes of rural poverty. For at least four decades, African governments and donors have experimented with a series of alternative approaches for redressing rural poverty, each giving way to a new paradigm as the persistence of poverty created disillusionment with prevailing approaches.[1] In 2000, more than 45% of Sub-Saharan Africa's population were estimated to be in poverty, and this situation has not improved in at least the last 15 years (World Bank 2000).[2]

Substantial research attention has been focused on the nature of rural poverty in Africa. Some key themes are: (1) growth and distributional linkage effects between agriculture and the rest of the economy (Mellor 1976; Reardon et al. 2000); (2) how to stimulate development in areas considered marginal by agroecological or geographic criteria, where poverty is presumed to be most severe (Hazell and Haddad 2001; Fan and Hazell 1999); and (3) the relationship between the distribution of rural assets, economic growth, and poverty reduction (Gugerty and Timmer 1999; Deininger and Squire 1998; Hoddinot, Haddad, and Mukherjee 2000).

This paper provides a micro-level foundation for discussions of income[3] and asset allocation within the smallholder sector, and explores the implications of these findings for rural growth and poverty alleviation strategies in the region. Results are drawn from nationally-representative household surveys in five countries between 1990 and 2000: Ethiopia, Kenya, Rwanda, Mozambique, and Zambia. The paper addresses five major points: (1) why geographically-based poverty reduction or targeting strategies—e.g., focusing on marginal areas—is likely to miss a significant share of the poor in any particular country regardless of targeting efficiency in these areas; (2) why current enthusiasm for community-driven development approaches will require serious attention to how resources are allocated at local levels; (3) why sustained income growth for the poorest strata of the rural population will depend on agricultural growth in most countries, even though the poor generally lack the land and other productive resources to respond directly or immediately to policies and investments to stimulate agricultural growth; (4) why agricultural productivity growth, while most easily generating gains for better-off smallholder farmers, is likely to offer the best potential for pulling the poorest and land-constrained households out of poverty; and (5) why meaningful poverty alleviation strategies in

[1] These broad strategies included "growth and trickle down" in the 1960s; integrated rural development and basic human needs in the 1970s; structural adjustment and economic liberalization in the 1980s and 1990s; and most recently participatory poverty alleviation strategies. See Staatz and Eicher (1990) for an historical review of agricultural development ideas.

[2] The percentage of people living in poverty, defined as income of less than US$1 a day, increased in the mid-1990s before it slightly improved in the late 1990s to the level prevailing during the late 1980s (World Bank 2000).

[3] Although the use of income as a proxy of household welfare has been criticized for its incomplete coverage of all income generating activities and inaccuracies (Deaton 1997), it is generally accepted that income is a key indicator of household economic activity and welfare.

many countries will require fundamental changes to make land more accessible to smallholder farmers. This could be accomplished through various processes, including improvement in land rental markets or perhaps land redistribution.

2. COUNTRY DATABASES

The smallholder household survey data sets used in this study were generally derived from national statistical agencies. In every country, the surveys are confined to small-scale farm households (generally defined as households owning less than 10 hectares of land). In Zambia's case, medium-scale farmers, defined as cropping 5-20 hectares, are also included, but this group accounts for less than 5% of the national sample. In no cases are large-scale farmers included in the samples.

In Ethiopia, data are derived from two linked surveys undertaken in 1995 and 1996 by the Central Statistical Authority. These are the National Agricultural Survey of 1995 and the Food Security Survey, jointly designed by the Ministry of Economic Development and Cooperation, and the Grain Market Research Project. The data set, containing 2,658 households, is representative to the zonal level. The Kenya Agricultural Monitoring and Policy Analysis Project 1997 survey, a joint undertaking by Tegemeo Institute/Egerton University and Michigan State University, contains 1,416 households and is designed to be representative of 24 purposively chosen agricultural districts of the country. These districts were chosen to be representative of the agricultural, but not pastoral, areas of the country. The data from Mozambique come from the 1996 Ministry of Agriculture and Rural Development (MADER) Smallholder Survey, a nationally-representative survey of 3,851 households. The Rwanda results are derived from the 1991 DSA/Ministry of Agriculture Survey, containing 1,108 households and which also is nationally representative.[4] Lastly, the Zambia results are derived from two linked surveys covering the 1999/2000 crop year. The Central Statistical Office(CSO)'s Post-Harvest Survey contains 6,330 agricultural households and is nationally-representative at the district level. The CSO revisited these 6,330 households in May 2000 with technical support from Michigan State University to obtain additional household-level information.

[4] The survey instruments for Zambia, Kenya, Rwanda, and Mozambique and other details of these data sets are downloadable at: http//www.aec.msu.edu/agecon/fs2/. For Rwanda data on land and income among smallholder in the year 2000 are now being processed. Until these are available, the 1990 data are the best indicators of conditions in rural Rwanda.

3. RURAL INCOMES: LEVELS AND DISTRIBUTION

Table 1 presents the level and variability of rural per capita household income in the five countries. We caution against strict comparisons of absolute values of per capita income across countries because of differences in survey methods and data across countries (see Appendix A for income definitions for all countries). Mean annual per capita household incomes varied from $337 in Kenya to $43 in Mozambique. Yet these mean figures hide great variations across the sample. After ranking all households in each country sample according to per capita income, and then dividing them into four equal groups, we find that the mean per capita income of the top quartile is typically 15 to 25 times higher than that of the bottom income quartile (Table 1, column c). In absolute terms, about 75% of the rural population is below the poverty line, as established from various sources, but the bottom 25% of the distribution is very much worse off in terms of income, than the middle or third quartile. A major question for development strategy is to identify means to promote economic growth in ways that are "pro-poor," or in other words, in broad-based ways that reach the poorest of the poor.

To examine the income distribution more carefully, we use two inequality measurements. First, we use an easy-to-use measurement of inequality called RELGAP, suggested by Gugerty and Timmer (1999). RELGAP is equal to the difference between the top and bottom quartile means, divided by the overall sample mean (column d). Gugerty and Timmer (1999) consider a RELGAP greater than 2.0 based on *quintiles* to indicate significant inequality; values greater than this magnitude based on *quartiles* would indicate even more significant inequality. We also present the Gini coefficient, a more common measurement of inequality. According to Deininger and Squire (1996), the average income Gini coefficient in Sub-Saharan Africa, based on 40 surveys that passed their data-quality criteria, is .45, while it is .50 in Latin America, where income inequalities are generally considered to be relatively severe. Thus, Kenya's Gini coefficient of .52 is above the Sub-Saharan African average and just above the Latin American average. Income disparities in Ethiopia are even greater than in Kenya: the RELGAP is 2.41 and the Gini is .59. Zambia's income disparities appear to be the most severe of the five countries with a Gini coefficient of 0.60.

In Rwanda and Mozambique, the income distributions are slightly less skewed than the other two countries, but still significant. These Gini coefficients are quite a bit higher than those reported for rural areas by Haggblade and Hazell (1988) for a group of African countries' in the 1970s. These Gini estimates are also generally higher than Haggblade and Hazell's estimates for rural Asia from the 1960s and 1970s (pg. 23). This might be considered especially surprising considering that the large-scale farming sectors in countries such as Kenya and Zambia are not even included in the samples. In two of the countries for which estimates are reported both in Table 1 and in Haggblade and Hazell—Zambia and Kenya—the distribution of rural incomes appear to have widened over the past two decades, although differences in survey design and samples warrant caution in these comparisons. But at least there is *prima facie* evidence that income distribution may be worsening in these countries over time, and that rural income distribution is actually worse in these African countries in the late 1990s than in most of Asia at the time of the green revolution there.

Table 1. Smallholder Income and Poverty in Selected African Countries

Country	(a) Number of sample households	(c) Household Per Capita Income					(d) Income Distribution		(e) Poverty	
		Ave.	Quartile[1]				RELGAP[1]	Gini	Headcount	Poverty Gap
			1	2	3	4				
		---------- US$ in survey year ----------							– % –	
Kenya 1997	1,416	336.9	52.7	159.9	306.5	827.6	2.30	0.52	55.2	0.30
Ethiopia 1995	2,658	71.6	10.8	29.8	57.2	183.1	2.41	0.59	75.1	0.40
Rwanda 1990	1,128	78.7	25.6	46.7	71.4	171.3	1.85	0.41	n.a.	n.a.
Mozambique[2] 1996	2,168	43.1	7.2	20.7	37.8	103.6	2.24	0.52	97.1	0.763
Zambia 2000	6,801	57.7	8.4	23.6	47.8	151.0	2.60	0.60	n.a.	n.a.

Note: Numbers for Ethiopia, Rwanda, Mozambique, and Zambia, including Gini coefficients, are weighted. Numbers for Kenya are sample statistics.
[1] RELGAP is the difference in mean income between the first and fourth quartiles divided by the mean.
[2] North-Central Mozambique only.

Poverty line for Kenya: Ksh 14,868 (US$256.3) (Welfare Monitoring Survey).
Poverty line for Ethiopia: Birr 603.6 (US$97.4) (Dercon and Krishnan 1998).
Poverty line for Mozambique: Mtc 1,929,360 (US$170) (The Survey of Households and Living Conditions, 1995/96).
Comparable poverty line information for the Rwanda and Zambia surveys used in this paper is not available.

4. THE GEOGRAPHIC DIMENSION OF POVERTY

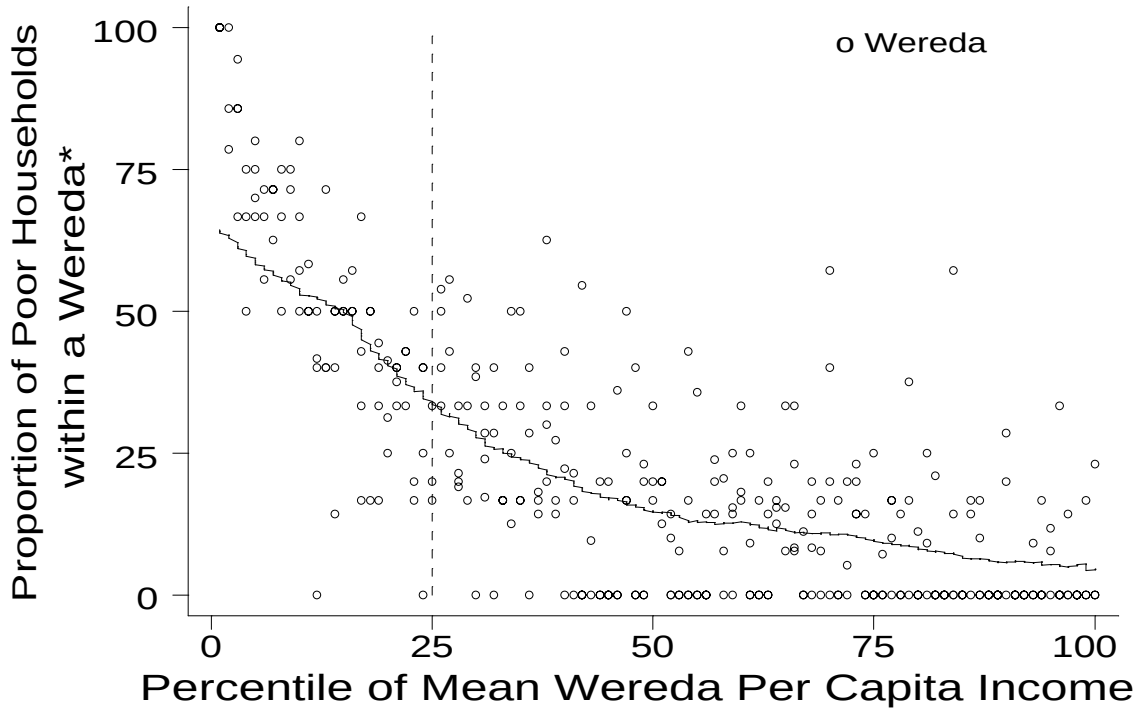
There is a longstanding debate over whether the poor would be better served by focusing public interventions and investments directly in less favored regions or by investing scarce resources in areas that provide the highest returns and facilitating the development of markets to spread the benefits to more marginal areas. Note that way that this question is framed appears to tacitly accept that the poor are mainly located in the less favored regions, with "less favored" being defined generally in agroecological terms. Yet we find that in each of the five countries there is only a weak geographic dimension to the distribution of rural per capita incomes. Regressing per capita incomes on provincial level dummy variables, the R^2 of these models never exceeds 0.10 (Table 2). This is equivalent to an ANOVA test measuring the extent of inter-provincial vs. intra-provincial variation. When smaller geographic variables (districts) are used, the R^2 of these models only rises to the range of 0.10 to 0.20. And when using the smallest administrative unit in each of the data sets (villages or standard enumeration areas), the R^2 of these models indicates that only 10% to 35% of the variation in per capita incomes across these countries is between villages; the most important sources of variations in household incomes is *within* villages. This is not to suggest that there are no regional differences in incomes; in fact they may be quite significant. But despite such potential regional differences, the largest source of variation in household incomes must be found within regions.

Table 2. Percentage of Total Variations in Household Per Capita Income Explained by Geographic Factors

Country	Between Province Differences (a)	Between District Differences (b)	Between Village Differences (c)
	------% of total variation in household per capita income------		
Kenya	6.4	14.3	23.5
Ethiopia	1.6	3.1	35.8
Rwanda	7.9	11.3	19.2
Mozambique	1.3	5.2	20.3
Zambia	2.1	5.9	15.5

Note: These figures are the R^2's from regressing household per capita income on geographic categorical variables.
The specific administrative units used in each country for column (a), (b), and (c) were as follows:
Kenya: Province, District, village
Ethiopia: Killil, Zone, Wereda
Rwanda: Prefecture, ID, Stratification
Mozambique: Province, District, village
Zambia: Province, District, Standard Enumeration Area (smallest geographic sampling unit in the survey)

Figure 1. Relationship Between Mean Community-Level (Wereda) Per Capita Income and the Incidence of Poverty Within Weredas, 1995/96 Crop Year, Ethiopia



* "Poor" defined as falling in the poorest 25% of all households in the national sample.
Source: Central Statistical Authority, Agricultural Production Survey and Food Security Survey.

To illustrate this point concretely using the Ethiopia data, we ranked all *weredas* (local administrative units of which there are roughly 450 in rural Ethiopia) in the national sample (n=348) according to their mean pre-foodaid per capita income and plotted these values against the percentage of households in each wereda falling into the bottom per capita income quartile ranked nationally. Figure 1 shows a negative but highly variable relationship.[5] For example, at the 25th percentile of mean pre-aid per capita income (vertical dotted line) as many as 60% or as little as 18% of the households belonged to the poorest national income quartile. Because of the wide within-wereda variation in pre-aid per capita income, the poorest 25% of the weredas in the country (those to the left of the dotted line) in the 1995/96 survey year were found to contain

[5] The locally-weighted regression line in Figure 1 and the other figures in this paper are created using locally weighted smoothed scatter plots (LOWESS) with window length set at .6 or .7 of the neighboring observations (Cleveland 1979). We truncated the graph at the bottom and top 5% of per capita income because the shape of the line is sensitive to the small number of observations.

only 54% of the nation's poorest households (those falling into the bottom national pre-aid per capita income quartile), and these weredas did not cluster into particular regions; they were dispersed throughout the country. The other 46% of households in the bottom national income quartile were scattered throughout the other 75% of the weredas.

These findings indicate the limitations of conceiving of poverty as a geographic phenomenon (even when the geographic unit is quite small) or formulating area-based solutions to the poverty problem. The generalized finding across all countries examined here is that a large share of the poorest smallholder households in the country are the neighbors of smallholder households that are relatively well-off. This finding implies that growth linkages should be easier to stimulate, assuming that there is some stimulus that at least the better-off smallholder farmers can respond to, than if the relatively poor and non-poor were segregated mainly geographically. We now explore the possible reasons for large intra-village variations in incomes.

5. LAND DISTRIBUTION

Land is arguably the most important asset in primarily agrarian rural societies. Inequality in land distribution has been found to have a strong inverse relationship with economic growth and poverty reduction. For instance, inequality in land distribution has been found to negatively affect future economic growth (Quan and Koo 1985; Deninger and Squire 1998), and even in the process of growth, poor households appear to benefit less than non-poor households when income and assets are distributed unequally (Gugerty and Timmer 1999).

It is well recognized that severe land inequalities persist in many African countries between smallholder, large-scale, and state farms. Redressing these inequalities may be in some countries an important element of an effective rural poverty reduction strategy. But setting that issue aside for the moment, too little research attention has been given in recent years to the possibility of significant differences in household access to land *within* the smallholder sector.[6] If such variation can be shown, then considerable work is also needed to explore its significance for rural poverty reduction strategies and programs.

Most of the recent policy-oriented work on land in Africa has focused on (a) how tenure type affects farmers' perceptions of security and their investments to augment land productivity (Atwood 1990; Migot-Adholla et al. 1991; Place and Hazell 1993; Besley 1995); (b) the impact of alternative institutional arrangements for transferring land on rural growth and equity (Deininger and Binswanger 1999; Maxwell and Wiebe 1999); and (c) differences in land allocation and productivity between large-scale and smallholder farms with implications for land redistribution (Deininger and Binswanger 1995; IFAD 2000; Adams and Howell 2001).

In the Eastern and Southern Africa region, much of this work treats the smallholder farm sector as a relatively homogeneous "unimodal" group with small but equitably distributed land holdings, which is placed within the larger framework of a "bi-modal" distribution of land between large-scale and small-scale farming sectors. Although there have been detailed studies on traditional tenure systems and their evolution based on localized field studies (Bruce 1993; Basset and Crummy 1993; Platteau 1996), surprisingly little research has been devoted to quantifying the distribution of land within the smallholder farm sector based on nationwide surveys, and exploring whether this distribution requires special consideration in the development of rural growth strategies in Africa. Some research (e.g., Block and Foltz 1999) refers to a skewed distribution of land in many Sahelian countries, and there has been longstanding reference to "rural differentiation" in the African development literature (e.g., Hill 1968). Yet a current empirical understanding of how land, other assets, and income are distributed within the small farm sector in many African countries remains elusive.

[6] Previous studies include Crawford and Thorbecke (1978), Ghai and Radwan (1983), and Haggblade and Hazell (1988). Tschirley and Weber (1994) explicitly examined land distribution in Mozambique's smallholder sector and showed that land holdings were the key determinant of household incomes and calorie availability. Marrule (1998) examined the reasons for the highly skewed distribution in Mozambique's smallholder sector.

Table 3 presents basic information on land access size and distribution within the smallholder farm sector in the six countries. We added available secondary data from Malawi and two additional surveys in Rwanda for comparison. Definitions of "land access" differ from area to area but the minimum defining characteristic is land which is under the households' "use rights" so long as it is regularly utilized.[7,8] As shown in Table 3, column b, average land holdings in the small farm sector range from 2.7 hectares in Kenya and Zambia to 0.71 hectares in Rwanda in 2000. The three Rwanda surveys indicate that mean household land access has declined significantly over the past 15 years,[9] a finding which appears to be generally true, although perhaps to a lesser degree in most of Africa, and to which we will return later.

On a household per capita basis, farm sizes range from 0.56 hectares per person in Zambia to 0.16 hectares per person in Rwanda in 2000 (column c). But these mean farm size figures mask great variations in land access within the smallholder sector. In each country, the "unimodal" pattern of land distribution typically assumed for the smallholder sector is shown to be inaccurate. For example, after ranking all smallholders by household per capita land size, and dividing them into four equal groups (quartiles), households in the highest per capita land quartile in Kenya own 1.10 hectares per capita, which is 14 times greater on average than the amount of land owned by households in the lowest quartile (0.08 hectares per person). In the four other countries studied here (Ethiopia, Rwanda, Mozambique, and Zambia), households in the highest per capita land quartile have control over about 8-20 times more land on average than households in the lowest quartile. These figures already include rented land (see footnote 7), which is marginal in most of the countries examined, hence showing the limited contribution that rental markets currently play in redressing variations in land/labor differences.

In all countries, the RELGAPs are greater than 2, suggesting significant inequalities. The Gini coefficients in column e also indicate a high degree of dispersion in land holdings, although it bears repeating that Gini comparisons across countries should be interpreted with caution because each survey employs different sampling frameworks.[10] Given relatively homogeneous production

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[7] This generally includes all cropped land, wood lots, fallow land, land under tree crops, gardens and rented land. As will be shown later, rented land makes up an extremely small part of overall land access (generally less than 0.1 hectares per capita on average).

[8] Because the results reported in this paper refer only to agricultural households, by definition, the surveys contain virtually no households with no access to land. However, initial village listings enumerated all household, and the percentage of households that owned absolutely no land is low, less than 4%. Landlessness is undoubtedly higher in areas closer to rural towns, where a higher proportion of households are engaged in exclusively off-farm activities. In Kenya's case, overall landlessness was roughly 18% in 1994 (Development Welfare Monitoring Survey 1994) but this sample includes households in provincial and district towns. Landlessness in rural villages appears to be much lower. Yet, as the results presented in this section indicate, there is very little difference between absolute landlessness and the 25% of households in rural areas that appear to have less than 0.1 hectares per capita.

[9] Andre and Platteau (1998) present an in-depth case study which shows acute competition over land and suggests a connection between land disputes and the civil war in 1994.

[10] Gini coefficients are a measure of inequality which vary from zero (perfect equality) to one (extreme inequality).

Table 3. Smallholder Land Distribution in Selected African Countries

Country	(a) # of sample HH's	(b) Ave. land access by HHs	(c) Household Per Capita Land Access					(d) RELGAP[1]	(e) Gini Coefficients		
			Ave.	Quartile [1]					Land per household	Land per capita	Land per adult
				1	2	3	4				
		– ha –	– ha –		– ha –						
Kenya	1,416	2.65	0.41	0.08	0.17	0.31	1.10	2.5	0.55	0.56	0.54
Ethiopia	2,658	1.17	0.24	0.03	0.12	0.22	0.58	2.2	0.55	0.55	0.55
Rwanda 1984	2018	1.20	0.28	0.07	0.15	0.26	0.62	2.1	--	--	--
Rwanda 1990	1,181	0.94	0.17	0.05	0.10	0.16	0.39	1.9	0.43	0.43	0.41
Rwanda 2000	1,584	0.71	0.16	0.02	0.06	0.13	0.43	2.4	0.52	0.54	0.54
Malawi[3]	5,657	0.99	0.22	0.08	0.15	0.25	0.60	2.4	--	--	--
Zambia	6,618	2.76	0.56	0.12	0.26	0.48	1.36	2.2	0.44	0.50	0.51
Mozambique	3,851	2.10	0.48	0.10	0.23	0.40	1.16	2.2	0.45	0.51	0.48

Note: Numbers for Ethiopia, Rwanda, Mozambique, and Zambia, including Gini coefficients, are weighted. Numbers for Kenya are sample statistics.

[1] RELGAP is the difference in mean land size between the first and fourth quartiles divided by the mean.

[3] National Economic Council of Malawi 2000.

technology, if land is allocated according to household size or labor availability, we should find more equal land distribution in household *per capita* or *per adult* land holdings than *per household* land holdings. This would imply that the Gini coefficients of land holding by household per capita and per adult measures should be smaller than the Gini coefficient of land per household. This is not the case in any of the five countries examined. The Gini coefficients of per capita and per adult land holdings are virtually unchanged in Kenya, Ethiopia, and Rwanda, and are even higher in Mozambique and Zambia when family size is accounted for in the estimates of land distribution inequality.

6. MOST OF THE VARIATION IN SMALLHOLDER LANDHOLDING SIZES CANNOT BE EXPLAINED BY OBSERVED HOUSEHOLD AND GEOGRAPHIC FACTORS

Households in densely populated areas generally have smaller per capita land sizes than households in less populated areas. Geographic factors obviously should affect land holding size but by how much? Do households in the same locality have about the same amounts of land per capita? To investigate these questions, we employ a similar technique as before, regressing land per capita on geographic administrative units of differing size, using OLS. If all households in each province have the same amount of land per capita but there are differences between provinces, then provincial effects should explain the entire variation in per capita land holdings. On the other hand, if mean land holdings are the same across provinces, then the province variable should not explain any of the variation.

Results in Table 4, column a, indicate that the province variable explains only between 3% and 12% of the variations in household per capita land sizes across the national samples. We then examine geographic differences at successively smaller units of administrative dis-aggregation: districts and villages. As we use smaller units, the proportion of variation explained by geographic units naturally increases, but only moderately so. In Kenya, Zambia and Ethiopia, between 15% to 33% of the total variation in per capita landholding sizes can be attributed to between-village effects (column c). In Mozambique and Rwanda, village-level effects explain less than 20% of total variation in per capita landholding sizes. The remaining (unexplained) variations exist within villages.

To explain these intra-village variations, we re-estimate the analysis with village dummies and also include household characteristics, such as the number of household members,[11] sex and age composition within the household, household heads' characteristics (age, gender, and education), and the value of animal assets, draft traction equipment, and transport equipment. Under the assumption that land is allocated to households according to productive assets and family demographics, the inclusion of these household characteristics should greatly increase the explained variation in landholding sizes. The results are shown in the last column of Table 4. In Kenya, the proportion of explained variation increases from 33% to 52%. It also increases in the other four countries, but still most of the variation in per capita land holdings remains unexplained. The combined village- and household-level characteristics explain only 36% of the total variation in household per capita land holdings in Zambia, 45% in Rwanda, and only about 25% and 30% in Ethiopia and Mozambique.

[11] Number of household members included as a regressor to account for possible non-linearities between household size and household landholdings per capita.

Table 4. Percentage of Variations in Household Per Capita Land Access Explained by Geographic Factors and Household Attributes

Country	Between Province Differences (a)	Between District Differences (b)	Between Village Differences (c)	Village and Household Attributes (d)
	------% of total variation in household per capita Land Access------			
Kenya	7.7%	15.9%	33.3%	52.4%
Ethiopia	2.9%	8.2%	21.9%	23.6%
Rwanda	5.2%	8.6%	17.1%	44.8%
Mozambique	6.5%	8.5%	18.2%	30.4%
Zambia	11.9%	17.3%	26.9%	33.9%

Notes:
1. These figures are the R^2s from regressing household per capita income on geographic categorical variables.
2. The specific administrative units used in each country for column (a), (b), and (c) were as follows:
Kenya: Province, District, village
Ethiopia: Killil, Zone, Wereda
Rwanda: Prefecture, ID, Stratification
Mozambique: Province, District, village
Zambia: Province, District, Standard Enumeration Areas
3. In column (d), the household-level variables added to village dummies include: value of animal ownership and traction equipment per capita (traction equipment not included in the case of Rwanda); education of household head; age of household head; number of female household members; number of male household members; number of household members in particular age brackets (under six, males between 6-14, females between 6-14, males between 15-64, and females between 15-64); and dummy variables for married female-headed households, and single female-headed households.

What factors could be explaining the high proportion of unexplained variation in household per capita landholding size within the smallholder farm sector in these five countries? Since the column (c) and (d) results include village-level dummy variables, the unexplained residual cannot be explained in terms of unobserved spatial differences between villages. Some intra-village geographical factors remain unaccounted for. The results indicate that there are unobserved intra-village and/or household-level characteristics that account for the majority of variation in household farm size per capita in four of the five countries examined.

How can we explain the finding that most of the variation in landholding size is a within-village phenomenon? Research in other disciplines has highlighted the importance of the period of the clan's settlement in a particular area in determining land allocated to the clan, which is sub-divided among families within the clan (Kajoba 1994; Block and Foltz 1999). Late migrants into an area typically are eligible for relatively small tracts of land for sub-division within the areas controlled by their clans. Evidence from key informant interviews in several of these African

countries also suggests that kinship ties and power relationships within traditional governance structures also partially explain the observed disparities in land allocation (Marrule 1998). These initial results lead us to propose that there may be institutional and governance factors operating within local systems for allocating land that may be accounting for at least some of the unexplained variation in per capita landholding size within the smallholder farm sector. While the World Bank and others have stressed the importance of providing greater local authority over issues such as land allocation, taxation, and public investment prioritization, these results on land allocation—which largely reflect the outcome of local governance decisions—raise questions as to how decentralization can be structured to ensure more equitable resource allocation.[12]

[12] Mozambique's new national land law has garnered a good deal of recognition for the seriousness with which it attempts to formalize local communities' involvement in land adjudication decisions. While much of the praise is probably justified, the law ignores local dynamics that may result in very inequitable distribution within the communities.

7. THE RELATIONSHIP BETWEEN LAND AND INCOME INEQUALITIES

So far we have shown significant disparities in both income and land distributions in all five countries. How, then, does the disparity in land allocation affect the distribution of income? Does relatively unequal land allocation indicate a high inequality in income distribution? In recent years, there have been many studies on economic growth and income inequality (see, for instance, Gugerty and Timmer 1999; World Bank 2000), searching for policies that achieve high economic growth while alleviating poverty. The achievement of such "pro-poor" economic growth may of course hinge on the distribution of productive assets throughout the population. In primarily agrarian societies, land is one of the most important productive assets, and the relationship between land and income inequality may be quite strong. To examine this issue, we plot per capita land and income Gini coefficients in Figure 2. Before we interpret the results in Figure 2, let us consider three extreme cases.

First, suppose that all households in a country have farm income only and that their return per unit of land is equal, regardless of their land size. In this case, the land distribution has a one-for-one relationship with the income distribution, and an increase in the land inequality increases the income inequality by the same magnitude. In Figure 2, we will find this situation on the 45 degree line. If there is a negative relationship between the average returns to land and land size (if, for example, small farmers are more productive or produce higher-value crops than relatively large smallholders), then an increase in land inequality will result in a proportionately smaller increase in income inequality. We will find this case below the 45 degree line. On the other hand, if there is a positive relationship between the average returns to land are increasing with land size, then an increase in land inequality will produce a proportionately larger increase in income inequality (above the 45 degree line).

Second, let us consider the opposite extreme case: all households in a country have off-farm income only, and the size of off-farm income does not have any relationship with the size of land. In this case, the land distribution has no casual effect on income distribution. Third, suppose again that all households have off-farm income only, but the land size does affect the size of off-farm income. Suppose the effect is positive as commonly found in Africa (Reardon et al. 2000), i.e., households with relatively large land sizes have higher off-farm income because land can be used as collateral or generates investment capital from crop sales that can be used for non-farm businesses. In this case, the income inequality will be larger than the land inequality (above the 45 degree line in Figure 2). If the effect is negative, i.e., households with relatively small land sizes have higher off-farm income than others, then the income inequality will be smaller than the land inequality (below the 45 degree line).

Figure 2 shows that in four countries (Mozambique, Ethiopia, Kenya, and Zambia) the income Gini coefficients are at similar levels, ranging from 0.52 to 0.60. In these countries, however, the land inequalities are at quite different levels. Kenya's Gini coefficient on per capita income is much smaller than its Gini coefficient of per capita land. This could result from declining average returns to land as landholding size rises and/or high off-farm income share among households in the lowest and second lowest land quartiles. In contrast, the level of inequality in

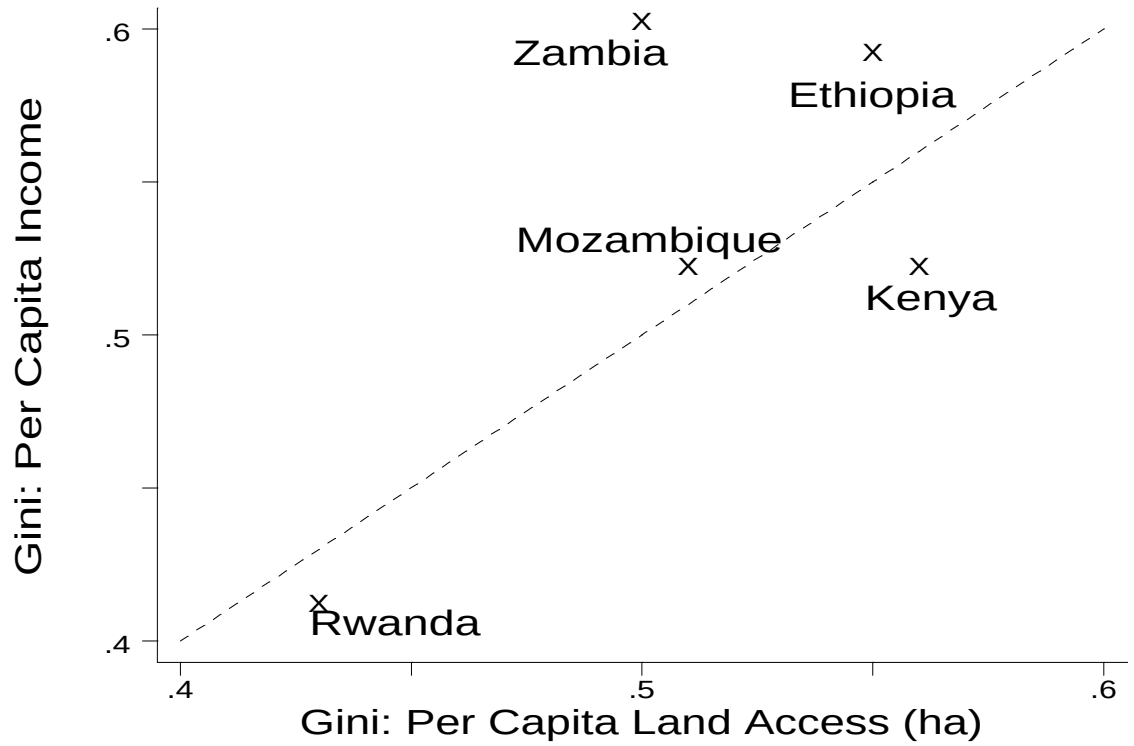
income in Mozambique and Zambia is higher than the level of inequality in land. This is consistent with the fact that off-farm income shares in these two countries are relatively low among smallholder households.

The importance of these findings for rural growth and poverty alleviation strategies depends in part on the degree to which land allocation patterns influence household income and poverty. If non-farm activities are able to compensate for small landholdings and provide land-poor households with adequate alternative income sources, then disparities in land ownership should not necessarily be a policy problem. Moreover, land rental markets may allow for some reallocation of land use and weaken the correlation between land ownership size and household income. To examine these issues, we present simple bivariate graphs relating household per capita landholding size to household per capita income, including non-farm income and crop income from rented land (Figure 3). The three dashed vertical lines show the 25th, 50th, and 75th percentiles of sampled households along the x-axis. For example, 25% of the sample households in Kenya have between zero and approximately 0.10 hectares per capita, while the top quartile owns on average 1.1 hectares per capita.

In each country, we find a positive association between household per capita land holdings and per capita income (the sum of farm, non-farm, and livestock income). The association is especially steep among households whose land size is below the median level (the middle dotted line in Figure 3) in each country. Because the vertical axis showing per capita income is in log form, we can read differences in numbers as percent changes. For instance, the line for Kenya starts at the log of per capita income at 9.2 and has a kink at 9.6. The difference between these two points is 0.4, which indicates a 40% increase in per capita income when household per capita land size increases from zero to 0.25 hectares. The same increase in land holdings (from zero to 0.25 hectares) increases per capita income by more than 40% in Rwanda, just less than 40% in Mozambique, and about 30% in Ethiopia. In all four countries, the association between land and income becomes weaker somewhere within the third land size quartile, and nearly disappears in the fourth quartile.

Other household characteristics by per capita income quartile groups can be seen in Appendix Table A2. There are some clear trends across the five countries, which are only briefly discussed here. First, the share of salary and non-agricultural wage increases with per capita income levels, and the share of agricultural wage labor decreases with income. This result might show the importance of education, as salaried jobs tend to require higher skills, while agricultural wage labor is mostly unskilled labor. A greater proportion of female-headed households tend to be in the bottom income quartiles in four of the five countries. Lastly, crop income per hectare tends to rise greatly with total income. This result may be driven by underlying differences in land quality (high income smallholders may farm more productive land) and/or differences in cropping patterns (high income smallholders may be more commercialized and grow higher-valued crops) or household asset holdings. Identifying the underlying factors behind this association between crop income per unit of land and total income per capita is the subject of further research.

Figure 2. The Relationship Between Land and Income Inequalities



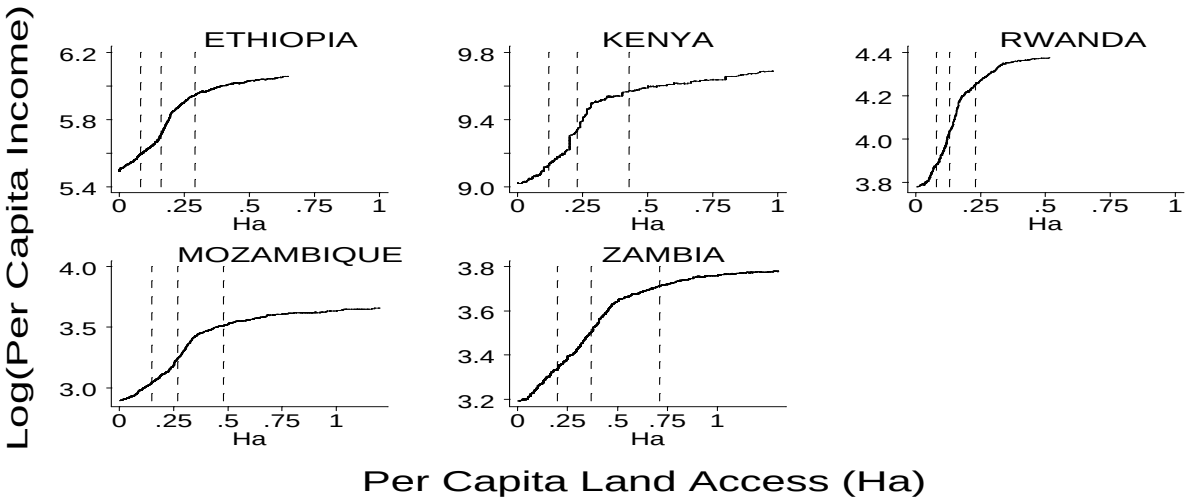
Note: Gini coefficients for per capita land and income, respectively, are 0.59 and 0.51 in Kenya; 0.51 and 0.51 in Ethiopia; 0.45 and 0.43 in Rwanda; 0.48 and 0.52 in Mozambique (central-north only); and 0.50 and 0.60 in Zambia.

Figure 3, however, only shows bivariate relationships between land and income. To examine the relationships between land and income controlling for other factors, we estimate village-level fixed effects OLS models with log of per capita income as dependent variables. By estimating these models, we estimate the relationship between land and income holding observable household characteristics constant within villages. Based on Figure 3, we decided to use a spline function to estimate the non-linear relationship between per capita land and per capita income in each country. The splined points (nodes) are determined for each country based on Figure 3: Kenya 0.25 ha; Ethiopia 0.15 ha; Rwanda 0.15 ha; Zambia 0.45 ha; and Mozambique 0.35 ha (all in per capita terms).

Results in Table 5 confirm statistically the non-linear relationship between land and income in each country.[13] The estimated coefficients of land among households with small landholdings

[13] By estimating the difference in coefficients before and after a nod, we found that the estimated difference was statistically significant for each country.

Figure 3. Log of Per Capita Income by Per Capita Land Owned



Note: The vertical lines are drawn at 25th, 50th, and 75th percentiles of per capita land owned for each country. The top 5% of observations are excluded from the graphs because lines are sensitive to a few extreme cases.

(before a node) indicate a strong relationship between land and income. In Kenya, for instance, 0.1 ha of per capita landholdings is associated with 11.7% higher per capita income. In Ethiopia and Rwanda, the percentages are much higher, 24.0% and 40.2%, respectively. The estimated coefficients of land among households with (relatively) large smallholders are much smaller. This result is consistent with the bivariate graphs in Figure 3. Reasons for small coefficients of land (flatness) among large smallholders could be (a) small farms with relatively high person-land ratios are more intensively cultivated than larger farms, thus leading to declining average returns as landholding size increases; and/or (b) relatively large smallholders are earning income from off-farm income sources, thus being less dependent on land, than small smallholders. The key consistent point across all countries examined is that at low levels of land access, just a little more land is associated with a major increase in income. But at higher levels of land ownership, there appears to be little relationship between land holding size and income per capita.

Table 5. Income Regression Analyses (Village level fixed-effects OLS)

	Kenya (a)	Ethiopia (b)	Rwanda (c)	Mozambique (d)	Zambia (e)
Dependent Variable: log(per capita income)					
Assets					
Per Capita Land Access	2.265	3.33	3.94	2.631	2.175
	(6.07)**	(7.86)**	(8.38)**	(8.85)**	(16.17)**
Per Capita Land Access, Splined	0.231	0.008	1.01	0.228	0.171
	(4.50)**	(0.25)	(9.47)**	(4.19)**	(6.81)**
Head's Education: primary	0.215	0.52	0.32	0.034	0.286
	(2.90)**	(1.27)	(7.39)**	(0.67)	(7.98)**
Head's Education: post primary	0.55	n.a.	n.a	0.309	0.773
	(8.05)**			(1.56)	(17.20)**
P.C. Value of Animals	$4.48*e^{-04}$	$5.79*e^{-4}$	0.64	0.016	0.004
	(9.60)**	(7.87)**	(6.02)**	(4.90)**	(12.41)**
P.C. Value of Animals Squared	$-2.66*e^{-10}$	$-6.87*e^{-8}$	-0.002	-3.69E-05	-0.001
	(-5.43)**	(-2.81)**	(-4.10)**	(4.65)**	(-7.07)**
Female Headed Households					
Female Headed, single	-0.66	-0.348	-0.18	-0.654	-0.149
	(-4.67)**	(-5.75)	(-4.26)**	(4.74)**	(-1.48)
Female Headed, married	0.44	-0.146	n.a.	-0.129	0.007
	(3.82)**	(-1.75)		(1.70)	(0.11)
Demographics					
Number of Children under 6[a]	-0.04	-0.11	-0.06	-0.119	-0.010
	(-1.67)	(-6.35)**	(-3.28)**	(6.28)**	(-0.58)
Number of Boys Aged 7 to 14[b]	-0.046	-0.06	-0.08	-0.065	-0.077
	(-2.35)*	(-2.68)**	(-4.14)**	(2.59)*	(-6.19)**
Number of Girls Aged 7 to 14[b]	-0.054	-0.06	-0.06	-0.053	-0.061
	(-2.79)**	(-2.49)**	(-3.59)**	(2.14)*	(-4.66)**
Number of Male Adults	0.038	0.013	-0.006	-0.077	0.003
	(1.81)	(0.61)	(-0.35)	(2.77)**	(0.23)
Number of Female Adults	-0.071	-0.071	-0.015	-0.029	-0.043
	(-3.30)**	(-2.74)**	(-0.80)	(0.99)	(-3.15)**
Constant	9.15	5.48	4.17	3.131	2.832
	(33.80)**	(15.71)**	(28.59)**	(11.45)**	(13.84)**
Number of Observations	1,416	2,707	1,128	2,168	6,251
R-Squared	0.50	0.52	0.59	0.39	0.39

Note: Spline node point for land access in hectares per capita: Rwanda 0.15; Zambia 0.45; Ethiopia 0.15; Kenya 0.25; and Mozambique 0.35.

[a] age 5 in the case of Zambia.

[b] age 11 in the case of Zambia.

* Statistically significant at $\alpha < .05$.

** Statistically significant at $\alpha < .01$.

These estimated coefficients of land, however, could be biased because of endogeneity in landholdings: households may have relatively large landholdings because they have high income, rather than the opposite.[14] For instance, the estimated coefficients of land could be upward biased if omitted management skills of households are both positively correlated with land and income. On the other hand, omitted land quality information may create downward biases if the land quality is negatively correlated with landholdings but positively correlated with income. In addition, measurement errors in landholdings may also bring the estimated coefficients downward.[15]

Despite the potential endogeneity problem, we feel that the estimated coefficients of landholdings are reliable for two reasons. First, because land (sales) markets are not well functioning, there is general stability in landholding size across years, and difficulties in non-marginal adjustments in landholdings for most rural households. Second, we are estimating village-level fixed effects models so that differences in land quality across villages are already controlled for. Intra-village differences in land quality remain, but the major variations in land quality is almost certainly across, not within, villages.

Land is not the only variable that is significantly associated with income. Education level of household heads is also significantly correlated with income. In Kenya, if a household head has primary school education, the household has 22.1% more income than households whose heads do not have any education. A household whose head has post-primary level education has 54.8% more income than a household whose head does not have any education. In Rwanda, heads' education level also is associated with higher income. On the other hand, in Ethiopia education level of household heads does not have any significant association with income.

Per capita values of animals is positively associated with income but with a decreasing rate (concave). Households gain income through sales of animals and their products, and through the productivity gains from draft animals. However, the endogeneity of this variable is also a concern not only because of biases in the estimated coefficients of this variables but also because of biases in other variables, especially on land variables, created by the endogeneity problem in value of animals. To test this, we estimated the same models in Table 5 without per capita value of animals. The coefficient estimates on land and all other variables are very similar when the per capita value of animals is excluded (model results are not shown, but are available upon request).

It is generally understood that female-headed households are worse off than their male-headed counterparts. We use two dummy variables for female headed households: one is for female headed households whose female heads are single (e.g., divorced and widowed.), and the other is for female headed households whose female heads are married but their husbands are out of

[14] One way to test endogeneity is to use the Hausman test. But to use the Hausman test, we need instrumental variables that are correlated with landholdings but not correlated with income. We believe that we do not have such variables.

[15] Measurement error in an independent variable is known to cause a downwardly biased coefficient estimate.

town for most of a year. The results in Table 5 indicate that single-female-headed households have significantly less income than male headed households in all countries, but this is not the case for female-headed households where the husband is living off the farm. The largest difference is in Kenya and Mozambique: single-female headed households have 66% and 65% less income per capita than male headed households. In Ethiopia, the difference of 35% much less than in Kenya and Mozambique but are still high absolute level. In Kenya, married-female-headed households have actually 40% higher income than other male headed households. In a country where off-farm activities are relatively well-developed, these female-headed households may be relatively well-off as a result of receiving remittances from their husbands who are away from home.

Most of the demographics variables are negative and significant, except the number of male adults. This is because we use the per capita income as the dependent variables. Female adults and children make less income than male adults.

8. INCOME SHARE

The importance of landholdings to household welfare (income) depends primarily on the share of on-farm production in total income. To discuss this issue, we present income share by per capita land quartiles in Table 6 (Appendix Table A2 presents income shares by per capita income quartiles). As shown in Figure 3, average household per capita income increases as we move from the lowest to the highest household per capita land quartile. As a result, the percentage of households in poverty declines as we move from the lowest to the highest land quartile. In Kenya, about 70.9% of households in the lowest per capita land quartile are living under the poverty line. The percentage declines to 56.4%, 52.2%, and 32.4% in the second, third, and fourth household per capita land quartile, respectively. We find a similar pattern in all other countries.

The main reason for this pattern in each country is that households with small per capita landholdings are not able to earn enough off-farm income to compensate for their low farm income.[16] For instance, Kenyan households in the lowest per capita land quartile have a higher proportion of income from off-farm sources (42.1%) than households in the highest land per capita quartile (26.5%), but in absolute terms, households in the highest quartile earned more than households in the lowest quartile: households in the highest earned \$163 (\$616.0*0.265) on average, while households in the lowest quartile earned \$97.5 (\$231.6*0.421).

This same pattern—smallholder households with relatively small per capita farms earn a higher proportion of their income from non-farm sources, but a lower absolute level of non-farm income—also holds true in Rwanda and North-Central Mozambique. In Ethiopia, both the proportion and absolute value of off-farm income are higher among households in the lowest land per capita quartile. But the difference in off-farm income is quite small. In general, there is a positive correlation in Africa between land size and income from off-farm sources (Reardon et al. 2000).

One may ask whether the general finding of wide disparities in household per capita landholding size may be a natural outgrowth of broad based agricultural growth and increased commercialization, whereby relatively inefficient farmers leave agriculture as production costs decline, and become re-absorbed in non-farm sectors according to the model of structural transformation (Johnston and Mellor 1961; Mellor 1976). If this were true, we would expect to see households in the lowest per capita land size quartile having relatively high non-farm

[16] A possibility to weaken the positive correlation between land and income is the inverse association between farm size and crop output per unit of land. The inverse association is well established in the empirical literature, especially in Asia and Latin America, and is generally explained by the fact that relatively small farms use their land more intensively and devote a smaller portion of their land to fallow than larger smallholder farms. However, because of the order of magnitude differences in farm sizes across the samples in each country, the large farms generated substantially more total crop output than the small farms, even after accounting for crop income generated from rented land, which is already included in the figures in Table 4.

Table 6. Household Attributes by Per Capita Land Access Quartile

			Quartiles of Per Capita Land Access			
Country	**Dimension**	**Aver.**	**1**	**2**	**3**	**4**
Kenya	Land access (ha)	2.65	0.58	1.26	2.11	6.69
	Household members (number)	7.0	7.7	7.3	6.8	6.3
	Land access per capita	0.41	0.08	0.17	0.31	1.10
	Female headed households (%)	18	20	17	19	14
	Adults in household (number)	3.7	3.7	3.8	3.6	3.8
	Per capita income (1996 US$)	336.7	209.9	275.3	312.4	550.3
	Crop income share (%)	34.0	29.5	31.4	35.0	39.2
	Livestock prod. income share (%)	26.0	20.5	27.6	27.2	30.2
	Off-farm income share (%)	40.0	50.0	41.1	37.8	30.6
	of which: remittances	6.7	7.2	5.4	6.0	7.9
	business income	12.3	15.2	12.9	13.1	8.0
	non-ag. wage labor	17.7	23.0	18.7	16.1	12.8
	ag. wage labor	3.3	4.6	4.1	2.6	1.9
	Crop income per hectare (US$)	553.6	689.5	569.0	510.8	444.7
	Draft animals and equipment (US$ per capita)	221.6	59.6	124.9	143.8	559.5
Ethiopia	Land access (ha)	1.17	0.20	0.67	1.15	2.58
	Household size (members)	5.2	5.7	5.5	5.2	4.6
	Land access per capita (ha)	0.24	0.03	0.12	0.22	0.58
	Female headed households (%)	16.5	19.7	17.2	15.1	14.0
	Adults in household (number)	2.8	2.8	2.9	2.8	2.6
	Gross value of crop sales (1996 US$ per hh)	124.2	168.5	122.9	104.9	102.8
	Crop income per ha (1996 US$)	515	1,062	426	362	256
	Livestock value (1996 US$ per capita)	464	329	403	457	560
	Per capita income (1996 US$)	71.6	53.1	52.1	88.3	91.0
	Crop income share (%)	91.9	86.3	91.6	94.6	95.4
	Livestock prod. income share (%)	na	na	na	na	na
	Off-farm income share (%)	8.1	13.7	9.0	5.4	4.6
Rwanda[a]	HH Land access (ha)	.94	.32	.63	1.00	1.82
	Household members (number)	5.5	5.9	5.9	5.7	4.7
	HH Per capita land access (ha)	.19	.05	.11	.18	.42
	Female headed households (%)	18	15	17	20	22
	Adults in household (number)	2.7	2.5	2.7	2.9	2.7
	HH Per capita land rented in	.02	.01	.01	.02	.03
	HH Crop income per ha (1991 US$)	278.8	540.5	369.7	289.7	193.7
	Gross value of crop sales (1991 US$ per hh)	52.7	34.1	45.1	52.4	79.3
	Livestock value (US$ per capita)	12.7	4.2	7.3	11.7	27.6
	Per capita income (1991 US$)	78.7	54.5	59.4	79.3	121.7
	Crop income share (%)	70.3	61.7	70.6	72.9	75.8
	Livestock prod. income share (%)	4.9	3.8	5.0	4.9	6.0

Table 6. Household Attributes by Per Capita Land Access Quartile

Country	Dimension	Aver.	Quartiles of Per Capita Land Access 1	2	3	4
Rwanda (cont.)	*Off-farm income share (%)*	24.8	34.5	24.4	22.2	18.2
	Gifts received (%)	3.4	3.9	3.6	3.3	2.8
	Own business (%)	5.9	5.6	6.1	5.6	6.2
	Salary+ non-ag. wage labor (%)	10.1	15.7	8.7	8.8	7.4
	Ag. wage labor (%)	5.5	9.4	6.1	4.6	1.9
Mozambique[b]	HH land access (ha)	1.80	0.55	1.17	1.92	3.46
	Household members (number)	5.2	6.0	5.6	5.3	4.0
	HH land access per capita	0.41	0.10	0.21	0.37	0.97
	Female headed households (%)	14	13	14	11	16
	Adults in the household (number)	2.7	2.8	2.8	2.7	2.4
	HH Per capita income (1996 US$)	43.1	26.2	34.1	42.7	69.2
	Crop income share (%)	84.5	79.2	85.8	83.4	89.7
	Livestock prod. income share (%)	2.8	4.9	1.9	3.5	1.1
	Off-farm income share (%)	12.7	15.9	12.3	13.1	9.2
	of which: remittances	na	na	na	na	na
	business income	10.5	12.5	10.8	10.9	7.7
	wage labor	2.2	3.4	1.5	2.2	1.5
	HH Crop income per hectare (1996 US$)	82.3	186.3	110.1	82.6	58.0
	HH p.c. draft animals and equipment (1996 US$)	3.0	0.84	3.71	3.37	4.1
Zambia	HH Land access (ha)	2.81	0.79	1.61	2.68	6.16
	Household members (number)	5.78	6.79	6.11	5.55	4.69
	HH Land access per capita	0.58	0.12	0.26	0.49	1.46
	Female headed households (%)	23.8	27.7	22.6	21.8	22.1
	Adults in household (number)	3.16	3.58	3.25	3.07	2.73
	Per capita land rented (rented in minus loaned out)	0.21	0.10	0.17	0.29	0.51
	Per capita income (2000 US$)	62.9	48.2	53.3	65.9	84.2
	Crop income share (%)	67.2	57.2	69.5	69.2	72.8
	Livestock prod. income share (%)	4.4	4.3	4.8	4.2	4.3
	Off-farm income share (%)	28.4	38.5	25.7	26.6	22.9
	of which: remittances	5.2	5.5	4.3	4.8	6.0
	business income	13.8	16.4	12.6	14.0	12.3
	non-ag salary/wage labor	6.7	11.6	6.3	5.6	3.5
	Ag. wage labor	2.7	5.0	2.4	2.2	1.1
	of which: Small farm wage labor (%)	1.3	2.1	1.3	0.9	0.7
	Large farm wage labor (%)	1.4	2.9	1.1	1.3	0.4
	HH crop income per hectare (2000 US$)	98	169	102	77	45
	Draft animals and equipment (2000 US$ per capita)	39.3	24.9	37.5	39.0	54.6

Note: All numbers are weighted. Exchange rates: Kenya 58Ksh-1997 US$; Ethiopia 6.2birr-1996US$; Rwanda 125.1FRW-1991 US$; Mozambique 11,294 Meticais-1996 US$; and Zambia 2,811Kw-2000 US$. Income figures include gross income derived from crop production on rented land.

[a] For Rwanda: data not available for land loaned out, only data on rented land is included. Asset values include livestock only. Remittances include gifts.

[b] North-Central Mozambique only where income data is available; no data available for land loaned out, figures only include land rented in; TIA design makes difficult the distinction between ag and non-ag wage labor. Therefore the figure refers to ag + non-ag wage labor share.

incomes. But, as shown in Table 6, we tend to see the reverse. Unfortunately, the positive correlation between land size and off-farm income discussed above is difficult to interpret as a manifestation of the process of structural transformation, particularly in light of the fact that agricultural growth in most of Africa remains low. Growth in off-farm sectors will be critical to pull out of farming much of the population that is increasingly unable to secure a livelihood through farming given small and declining land holdings. And growth in non-farm sectors is generally shown to depend on broad-based agricultural growth. The evidence is compelling that sustained income growth for the poorest strata of the rural population will depend on agricultural growth in most countries, even though the poor generally lack the land and other productive resources to respond directly or immediately to policies and investments to stimulate agricultural growth. Agricultural productivity growth, while most easily generating gains for better-off smallholder farmers, is likely to offer the best potential for pulling the poorest and land-constrained households out of poverty.

The results in this section indicate a strong association between land holdings and income. These results are consistent with other studies (Hoddinot, Haddad, and Mukherjee 2000; Lopez and Valdes 2000). Improving access to land among the most land-constrained smallholder households would be a seemingly effective way to reduce poverty. Yet improving land access for smallholders is fraught with difficulties: even in "land abundant" countries, it is questionable whether much unclaimed land is available in settled areas to distribute, expropriative land reform is politically difficult, expensive, and subject to rent-seeking, "market-assisted" or "community-based" approaches have met with very little success to date.[17] We discuss alternative policy options in next section.

[17] See the draft World Bank document on land allocation for the electronic forum on land policy at www2.worldbank.org/hm/hmlandpolicy, especially Alain de Janvry's posting on 20 March 2001 and follow-up comments to it. See also Bassett and Crummy 1993; and Rahmato 1994.

9. IMPLICATIONS FOR POVERTY REDUCTION AND ECONOMIC GROWTH STRATEGIES

The findings presented in this paper point to several basic conclusions. **First, while there are some areas that tend to experience higher rates of poverty than other areas, the findings from these five countries—Ethiopia, Kenya, Mozambique, Rwanda, and Zambia—suggest that poverty among smallholder households is not primarily a geographic phenomenon.** Most of the variations in smallholder incomes tend to be within-village rather than between village, or in other words, the poor are geographically scattered throughout all regions of a country. This has implications for targeting vulnerable groups, assuming that income is the basis for targeting.[18] Geographically-based targeting and poverty reduction strategies—e.g., focusing on marginal areas—is likely to miss a large fraction of the poor in any particular country.[19] This is not to suggest that there are no regional differences in poverty and vulnerability; rather, the bulk of the variation in income in a particular country is found within regions, not between them. Targeting of vulnerable, resource poor households requires greater emphasis on intra-community targeting, as a complement to regional targeting. This makes targeting more challenging and costly to avoid private trading disincentives, if the development of private sector-led input and food marketing systems is considered to be an objective of government policy. On the positive side, the fact that poor as well as relatively better-off smallholder farmers are located in the same areas is good news for generating multiplier effects from agricultural growth.

Second, we find across all five countries serious disparities in incomes and land allocation at the local level. This may give pause to current development initiatives focusing on "community-driven development." While it is possible that village-level disparities in incomes and land could naturally occur as an outgrowth of differences in capabilities and entrepreneurship across households, it is at the very least important to ask whether local or national governance decisions over time play a role in generating such disparities. The data presented here is unable to provide a clear answer to this question. However, the findings do emphasize the need for promoting greater transparency and equity in village-level resource allocation decisions if there is to be a serious attempt to combat rural poverty, at least in the near future. This conclusion flows from the strong association between landholding size and per capita incomes, especially at low levels of landholding size. Over time, it is possible that broad-based economic growth can help pull landless and near-landless households into more remunerative non-farm activities, lessening the importance of access to land as a dominant determinant of income levels.

Third, we emphasize the importance of grounding the discussion of land allocation reforms within the context of a dynamic and sustainable rural growth strategy. The paper highlights

[18] Income is acknowledged to be an incomplete basis for determining vulnerability, but is one important determinant.

[19] Findings from India (Fan and Hazell 1999) even find that, on average, districts considered to be "marginal lands" have a lower proportion of households below the poverty line that high-potential districts.

a major structural problem within smallholder agriculture in selected African countries. Structural transformation requires broad-based income rural growth, and broad-based rural income growth is facilitated by relatively egalitarian distribution of rural assets (Gugerty and Timmer 1999). But around 50% of the rural small farm population cultivates less than 0.15 hectares per capita in densely populated countries such as Rwanda and Ethiopia, and less than 0.3 hectares per capita in supposedly land-abundant countries such as Zambia and Mozambique. Therefore, absent major reform in access to land the following processes in these countries are likely to continue: (1) farm sizes are likely to decline over time; (2) landlessness and near-landlessness will emerge as increasingly important social and economic problems unless growth in the non-farm sectors can be substantially increased; and (3) given existing agricultural technology and realistic projections of future productivity growth potential, large segments of the rural population will be unable to climb out of poverty through agricultural growth on their own farms.

Discussions of land allocation and their implications in Africa need to be considered in the context of increasing rural population densities and man/land ratios. FAO data since 1960 indicate that the ratio of land under crop cultivation to agricultural population (a rough proxy for per capita farm size) has been shrinking gradually but consistently in Africa. The FAO data indicate that some relatively densely populated countries such as Kenya and Ethiopia have seen this ratio cut in half over the past 40 years (Table 7). The decline in land/person ratios has been more gradual in the other countries, but the overall conclusion that the agricultural labor force is increasing faster than the area under crop cultivation appears to be very robust in all cases.

Table 7. Land to Person Ratio (10 year average) in Selected Countries

	1960-69	1970-79	1980-89	1990-99
Sub-Saharan Africa				
Ethiopia	0.508	0.450	0.363	0.252
Kenya	0.459	0.350	0.280	0.229
Mozambique	0.389	0.367	0.298	0.249
Rwanda	0.215	0.211	0.197	0.161
Zambia	1.367	1.073	0.896	0.779
Zimbabwe	0.726	0.664	0.583	0.525
Asia				
Indonesia	0.362	0.329	0.325	0.354
India	0.478	0.410	0.359	0.320
Malaysia	0.783	0.839	1.090	1.552
Pakistan	0.468	0.387	0.336	0.292
Thailand	0.524	0.566	0.634	0.693

Sources: FAO STAT.
Note: Land to person ration = (land cultivated to annual and permanent crops) / (population in agriculture).

The pattern is very different in Asia, with the exception of India and Pakistan. The latter two countries experienced sluggish growth prior to the 1990s, and show continuous declines in land/man ratios similar to Africa. Indonesia's ratio, however, bottomed out in the 1980s and increased in the 1990s. Malaysia and Thailand, both of which have had rapid and sustained growth for several decades, have experienced rising land/agricultural person ratios since at least the 1970s. The differential behavior of this ratio over time in these countries can be largely attributed to much more rapid growth in the non-farm economy in the Asian countries, which allowed rural households to leave farming and find more remunerative employment in the industrial and service sectors. This process, which is central to the structural transformation process, has largely not yet occurred in Africa.

In addition, Gugerty and Timmer (1999) provide evidence suggesting that an unequal distribution of assets can significantly reduce the contribution of subsequent economic growth to poverty reduction. In a sample of 69 countries, they found that, in countries with an initial "good" distribution of assets, both agricultural and non-agricultural growth benefitted the poorest households slightly more in percentage terms; the poor in these countries closed some of the gap with the rich in percentage terms. In countries with a "bad" distribution of assets, however, economic growth accrued mostly to the richer households, meaning that the gap between rich and poor increased. It is especially noteworthy that in this latter group of countries, agricultural growth was associated with greater increases in inequality than was non-agricultural growth. This reverses what has been considered the more typical pattern, wherein agricultural growth is seen to contribute more to poverty reduction than growth outside the agricultural sector. These findings reinforce the idea that where access to land is highly concentrated and where a sizable part of the rural population lack sufficient land to earn a livelihood, then special measures will be necessary to tackle the problem of persistent poverty. This is almost certain to be a long term undertaking, but avoiding the issue will only prolong the problem.

What are the implications of these recent empirical results—indicating a negative relationship between the concentration of rural assets and the poverty-reducing effects of economic growth—in the context of the findings presented in this paper about land allocation? It may be necessary to ask whether structural transformation processes may be retarded in situations in which the distribution of rural assets are so highly skewed that a large strata of the rural population may be unable to benefit from agricultural growth incentives that would otherwise generate broad-based growth multipliers. In some African countries, the distribution of land and other productive assets appears to be more skewed than available estimates for Asia at the time of the green revolution as well as most of South America. Education, which played a role in much of Asia by allowing households to exit agriculture into more lucrative off-farm jobs, is relatively low in most areas of rural Africa by world standards. Improving access to key assets, such as land and education, appears to be necessary to translate agricultural growth incentives into broad based structural transformation. We present this last issue as admittedly conjectural at this stage, but worthy of further research attention.

Economic growth is clearly a necessary condition to attack the problem of widespread poverty associated with near-landlessness observed in these countries (Wolgin 2001). Safety nets and

targeted programs will also continue to be important means of addressing poverty and vulnerability, but these measures in themselves are not geared to address the root causes of poverty, which are related to the generally low level of agricultural productivity. **This leads us to the forth major conclusion: sustained income growth for the poorest segment of the rural population is likely to depend on agricultural growth in most countries, even though the poor generally lack the land and other productive resources to respond directly or immediately to policies and investments to stimulate agricultural growth.**

Agricultural productivity growth, while most easily generating gains for better-off smallholder farmers, is likely to offer the best potential for sustained income growth among the poorest and land-constrained households as well. The literature on growth linkages indicates that the first-round beneficiaries of agricultural growth generate important multiplier effects by increasing their expenditures on a range of local off-farm and non-farm activities that create second-round benefits for a wide-range of other households in the rural economy (Johnston and Mellor 1961; Mellor 1976; Haggblade and Hazell 1988; Reardon et al. 2000). Income growth derived from agricultural productivity growth generates demand for non-farm activities that has absorbed the rural poor into more viable non-farm activities (Gabre-Madhin and Johnston, forthcoming). In much of Africa, the consumption growth linkages have been found to be especially important (Delgado and Minot 2000). The extent and magnitude of these second round effects depend on a number of factors, including education, infrastructure, and institutional development, but importantly include whether the income stimulus is widely spread (Delgado and Minot 2000; Fan and Hazell 1999). The initial distribution of land and other productive assets, which clearly influences how broad-based the first round beneficiaries of agricultural growth will be.

While sizeable segments of the smallholder populations do not have enough land assets to respond to “smallholder commercial agriculture” opportunities, the data suggest that there are smallholders with relatively more land and related assets, who probably can respond, and who are located in many of same villages as those who have relatively little land on a household per capita basis. This finding holds powerful implications for policy if shown to be widespread, as suggested by the data. Dynamic labor and services markets, and other employment opportunities should be easier to create (other factors constant) in the very locations where some smallholders are investing and raising their output and productivity. Pro-active public sector investment and policy support in developing these labor and service markets will be a key determinant of the magnitude of the growth linkages to be derived from agricultural growth.

9.1. Future Research

This paper is intended to present basic findings and raise questions for future analysis and poverty alleviation strategies. These may be segmented into two broad areas: first, without directly addressing the existing institutional arrangements governing land allocation, what are the most promising strategies for increasing the productivity of the scarce land that most rural small scale farmers have? Is the Asian model instructive for Africa: that is, should there be strategic focus to achieve productivity growth among the more commercially viable segments of the smallholder sector through technological and institutional innovation in key commodity

supply chains, and also a strategic focus to nurture the multiplier effects that create demand for off-farm and rural non-farm jobs? Is this the most realistic way to profoundly alleviate rural poverty in most African countries as was the case in Asia?

Second, what are the costs and benefits of alternative approaches for redressing the acute land constraints being faced by a significant portions of the rural smallholder population? Some of the issues might include (a) analyzing institutional arrangements for encouraging the development of land markets (for sale in addition to rent/share cropping) and attracting greater long-term land investments; (b) assessing the potential for land redistribution between state, large-scale, and small-scale farmland; (c) identifying the skills that make for a mobile labor force that facilitates structural transformation; and (d) identifying cost-effective public investments to induce migration into relatively sparsely populated areas in a manner that is supportive of rural productivity growth.

Many of these are not new questions, but the need to focus on them is given new importance in the face of the empirical evidence presented as to the disparities in access to land within the smallholder sectors in many African countries, and the difficulties of nurturing other avenues to rural income growth for households lacking access to sufficient land to ensure a decent livelihood.

APPENDIX 1

Table A1. Land Rental Markets in Selected Countries

Country Dimension	Aver.	Household Per Capita Land Access Quartile 1	2	3	4
Mozambique					
Total Land Access (ha)	2.10	0.64	1.32	2.16	4.23
Total Land Rented In (ha)	0.11	0.01	0.05	0.11	0.25
Total Land Rented Out (ha)	n.a.	n.a.	n.a.	n.a.	n.a.
Households Renting In (%)	11.40	6.10	8.50	13.80	17.30
Households Renting Out (%)	n.a.	n.a.	n.a.	n.a.	n.a.
Rwanda					
Total Land Access (ha)	0.94	0.32	0.63	1.00	1.82
Total Land Rented In (ha)	0.07	0.03	0.06	0.09	0.11
Total Land Rented Out (ha)	n.a.	n.a.	n.a.	n.a.	n.a.
Households Renting In (%)	41.40	37.40	49.30	44.40	34.60
Households Renting Out (%)	n.a.	n.a.	n.a.	n.a.	n.a.
Kenya					
Total Land Access (ha)	2.65	0.58	1.26	2.11	6.69
Total Land Rented In (ha)	0.31	0.54	0.17	0.20	0.31
Total Land Rented Out (ha)	0.19	0.02	0.03	0.13	0.57
Households Renting In (%)	18.10	26.20	22.30	12.50	11.70
Households Renting Out (%)	16.70	3.70	9.20	19.70	34.10
Ethiopia					
Total Land Access (ha)	1.17	0.20	0.67	1.15	2.58
Total Land Rented In (ha)	0.12	0.15	0.13	0.15	0.11
Total Land Rented Out (ha)	n.a.	n.a.	n.a.	n.a.	n.a.
Households Renting In (%)	23.50	27.40	29.00	26.80	17.20
Households Renting Out (%)	n.a.	n.a.	n.a.	n.a.	n.a.
Zambia					
Total Land Access (ha)	2.76	0.80	1.63	2.74	5.84
Total Land Rented In (ha)	0.01	0.02	0.00	0.01	0.00
Total Land Rented Out (ha)	0.01	0.01	0.01	0.01	0.02
Households Renting In (%)	n.a.	n.a.	n.a.	n.a.	n.a.
Households Renting Out (%)	n.a.	n.a.	n.a.	n.a.	n.a.

Note: Numbers are weighted. In Mozambique, most of this land was loaned informally.

Table A2. Household Attributes by Per Capita Income Quartile

Country	Attribute	Aver.	Quartiles of HH Per Capita Income 1	2	3	4
Rwanda	HH Land access (ha)	.94	.71	.85	.92	1.30
	HH Per capita land access (ha)	.19	.13	.15	.18	.30
	Household members (number)	5.5	5.8	5.9	5.5	4.9
	Female headed households (%)	18.5	23.9	17.7	14.7	17.6
	Adults in household (number)	2.7	2.6	2.7	2.6	2.8
	Per capita land rented in	.02	.01	.01	.01	.03
	Crop income per ha (1996 US$)	278.8	145.4	234.8	300.2	361.0
	Gross value of crop sales (1991 US$ per hh)	52.7	11.8	30.4	57.2	111.6
	Livestock value (US$ per capita)	12.7	6.1	9.6	13.4	21.5
	Per capita income (1991 US$)	78.7	25.6	46.7	71.4	171.3
	Crop income share (%)	70.3	68.9	72.5	71.9	67.7
	Livestock prod. income share (%)	4.9	3.5	5.3	6.0	4.8
	Off-farm income share (%)	24.8	27.6	22.2	22.1	27.5
	Gifts received (%)	3.4	5.5	2.8	2.9	2.4
	Own business (%)	5.9	5.9	5.4	5.8	6.4
	Salary+ non-ag. wage labor (%)	10.1	6.9	8.0	8.5	17.0
	Ag. wage labor (%)	5.5	9.3	5.9	4.9	1.7
Mozambique	HH Land access (ha)	1.80	1.24	1.68	1.89	2.33
	HH Per capita land access (ha)	0.41	0.22	0.31	0.41	0.69
	Household members (number)	5.2	5.9	5.7	5.1	4.3
	Female headed households (%)	14	18	11	15	11
	Adults in household (number)	2.6	2.9	2.7	2.6	2.4
	Crop income per ha (1996 US$)	82.3	37.1	62.4	85.4	116.1
	Gross value of crop sales (1996 US$ per hh)	35.4	5.7	19.8	32.7	80.8
	Asset value (US$ per capita)	5.3	2.9	4.8	5.5	8.3
	Per capita income (1996 US$)	43.1	7.2	20.7	37.8	103.6
	Crop income share (%)	84.5	88.0	90.1	85.6	74.8
	Livestock prod. income share (%)	2.8	5.2	1.1	2.8	2.4
	Off-farm income share (%)	12.7	6.8	8.8	11.6	22.8
	remittance (%)	na	na	na	na	na
	Own business (%)	10.5	3.8	7.3	9.4	20.8
	Salary+ wage labor (%)[1]	2.2	3.0	1.5	2.2	2.0
Kenya	HH land access (ha)	2.65	1.49	2.13	2.34	4.65
	HH per capita land access (ha)	0.41	0.24	0.30	0.38	0.74
	Household members (number)	7.0	7.2	7.3	7.0	6.5
	Female headed households (%)	17.7	26.6	19.2	15.3	9.8
	Adults in household (number)	3.7	3.4	3.7	3.9	4.0
	Per capita land rented in	0.015	0.012	0.022	-0.002	0.029
	Crop income per ha (1996 US$)	553.6	261.6	414.3	586.6	955.9
	Gross value of crop sales (1997 US$ per hh)	449.6	333.5	465.4	432.6	567.1
	Value of livestock and traction equipment (US$ per capita)[1]	221.6	61.9	135.9	135.1	553.5

Table A2. Household Attributes by Per Capita Income Quartile (con't.)

			Quartiles of HH Per Capita Income			
Country	**Attribute**	**Aver.**	**1**	**2**	**3**	**4**
Kenya-(cont.)	Per capita income (1997 US$)	112.9	40.8	66.6	172.5	172.1
	Crop income share (%)	34	40	32	30	32
	Livestock prod. income share (%)	26	28	28	24	24
	Off-farm income share (%)	40	33	39	45	44
	Gifts received (%)	7	7	7	7	7
	Own business (%)	12	11	12	12	14
	Salary+ non-ag. wage labor (%)	18	6	18	25	22
	Ag. wage labor (%)	03	8	2	1	1
Ethiopia	HH land access (ha)	1.16	0.94	1.07	1.16	1.47
	HH Per capita land access (ha)	0.24	0.18	0.21	0.25	0.33
	Household members (number)	5.2	5.5	5.5	5.2	4.8
	Female headed households (%)	16.5	22.1	16.3	16.5	11.5
	Adults in household (number)	2.8	2.7	2.7	2.8	2.8
	Per capita land rented (rented in only)	0.03	0.02	0.02	0.03	0.05
	Crop income per ha (1996 US$)	515	207	364	549	925
	Gross value of crop sales (1996 US$ per hh)	124.2	75.4	68.6	122.0	225.5
	Value of livestock (1996 US$ per capita)[1]	464.6	319.4	382.9	492.4	648.0
	Per capita income (1996 US$)[2]	71.6	10.8	29.7	57.1	183.1
	Crop income share (%)	92.7	86.0	89.0	93.9	96.8
	Livestock prod. income share (%)	na	na	na	na	na
	Off-farm income share (%)	7.3	14.1	11.0	6.1	3.2
Zambia	HH land access (ha)	2.76	2.27	2.65	2.99	3.12
	HH per Capita land access (ha)	0.56	0.42	0.48	0.58	0.75
	Household members (number)	5.9	6.3	6.0	5.8	5.3
	Female headed households (%)	24	31	28	19	17
	# of adults in household	3.24	3.34	3.25	3.25	3.12
	Per Capita land rented in (ha)					
	Crop income per ha (2000 US $)	98	38	73	109	175
	Gross Value of crop sales (2000 US $ per hh)	186.8	47.1	118.0	210.9	371.2
	Value of draft eq & animals (US $ percapita)	38.5	13.7	23.5	37.0	75.8
	Per Capita Income (2000 US $)	57.1	8.4	23.6	47.8	151.0
	Crop income share (%)	69.3	75.7	75.7	72.8	53.2
	Livestock prod income share (%)	3.4	3.0	3.0	3.9	3.8
	Off-farm income share (%)	27.3	21.3	21.3	23.7	43.0
	remittance (%)	5.7	10.7	5.9	3.67	2.9
	Own business (%)	14.8	8.7	12.7	14.3	23.0
	Salary + wage labor (%)	6.1	1.6	2.3	5.0	15.0
	Ag. Wage Labor (%)	2.4	29.4	21.0	1.7	3.1
	Small farm wage labor (%)	1.3	2.6	1.3	0.8	0.7
	Large farm wage labor (%)	1.0	0.1	0.4	1.0	2.5

Note: All numbers are weighted. Exchange rates: Kenya 58Ksh-1997 US$; Ethiopia 6.2birr-1996US$; Rwanda 125.1FRW-1991 US$; Mozambique 11,294 Meticais-1996 US$; and Zambia 2,811Kw-2000 US$. Income figures include gross income derived from crop production on rented land.

[1] TIA design makes difficult the distinction between ag and non-ag wage labor.

APPENDIX 2

INCOME DEFINITIONS

Kenya. Income is the sum of self-reported production value of all crops; plus the sum of individual level labor income; plus the sum of individual level micro-and-small enterprises; plus livestock sales; plus sales of livestock products; minus fertilizer costs. Crop production, livestock sales, and livestock production are valued by using district level prices. Netting out labor costs is not possible because we do not have information about the quantity and value of family and hired labor.

Ethiopia. Income is the sum of production value for food crops in the 1995 Meher growing season (harvest typically being from September through December) taken from crop cuttings; plus self-reported production value in 1995 for non-food crops such as coffee (no field cuttings were taken for these crops); plus an estimate of off-farm cash income contributed by each household member over the past year prior to the survey; minus fertilizer costs. Crop productions are valued by using district level prices. Netting out labor costs is not possible because we do not have information about the quantity and value of family and hired labor. We do not have information on income from livestock, such as livestock sales and livestock product sales.

Rwanda. Income is the summed value of the measured quantities of crops produced (self-consumption plus crop sales plus inputs for beer production); plus self-reported off-farm income (includes value added from beer sales, skilled labor, unskilled non-ag labor, unskilled ag-labor, gifts received, and other income such as from the sales of forestry products); plus income from livestock sales; minus costs of inputs (seeds withheld from production, fertilizer, pesticide, agricultural labor hired, feed and beer inputs purchased). Crop values and off-farm income are valued using prefecture level prices. All data cover the year 1990.

Mozambique. Rural household income is defined as the net value of income earned by resident members in the period September 1995 through August 1996, i.e., the 1995/96 agricultural season. It includes value of retained agricultural and livestock production, sales of agricultural and livestock production, off-household farm and non-farm labor sales plus the net micro and small enterprise income, less the cost of purchased agricultural/livestock inputs and paid labor.

Zambia. Income is the sum of crop, livestock, and non-farm income. Net crop income is defined as self-reported crop production multiplied by provincial-level mean producer prices for each crop, minus cash input costs. Information on labor costs was not available and this is not included in the derivation of net crop income. Sales of livestock and livestock products also do not include costs. Non-farm income is comprised of business income minus business expenses, hired labor income and salary income in cash and kind, and remittances from non-resident family members.

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