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

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## Abstract

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 between 1990 and 2000 in five countries: Ethiopia, Kenya, Rwanda, Mozambique, and Zambia. The paper shows that farm sizes in most of Africa are declining over time; that farm sizes appear to be declining at a faster rate for households at the low end of the land size distribution; that Gini coefficient measures indicate that farm sizes within the small-farm sectors are generally more inequitably distributed than in Asia and Latin America at the time of their green revolutions, not even considering the serious additional disparities in land allocation that would result if large-scale farming sectors were to be included in the several case countries having bi-modal land distribution patterns; and that the largest part of the variation in per capita farm sizes within the small-farm sectors is, in every country, predominantly within-village rather than between villages. Realistic discussions of poverty alleviation strategies in Africa need to be grounded in the context of these land distribution patterns and trends. The paper concludes by identifying the implications for poverty alleviation strategies.

JEL keywords: economic development, income distribution (O15); land ownership, land use (Q15); cross-sectional econometric models (C21); Africa (N970).

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

## 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 percent 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 disadvantaged by agro-ecological or geographic criteria (Hazell and Haddad 2001; Fan and Hazell 1999); (3) the relationship between the distribution of rural assets, economic growth, and poverty reduction (Gugerty and Timmer 1999; Deininger and Squire 1998; Hoddinott, Haddad, and Mukherjee 2000); and (4) recent advances in poverty mapping (Benson, 2002; Simler and Nhate 2002).

Due to the rise in the absolute number of Africans living in poverty, there has been increased emphasis among governments, international donors, and researchers, to identify strategies emphasizing "pro-poor" growth. This view reflects the understandable concern that income and productivity growth on their own represent a very inadequate approach to development if the gains are realized only by households in the top half of the income distribution. Strategic plans for poverty reduction have been prepared since 1998 with support from the World Bank by over 15 African governments. However, most of them provide only scant attention to the role of land access and land distribution in rural poverty.[3]

This paper provides a micro-level foundation for discussions of poverty and land allocation within the small-scale farm sector. We determine the relationship between access to land and

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[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 reduction strategies. See Staatz and Eicher (1998) 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, 2000a).

[3] For example, neither of the World Bank's (2000b) synthesis chapters on "Addressing Poverty and Inequality" or "Spurring Agriculture and Rural Development," contain any references to the role of constrained access to land or land distribution inequalities in contributing to poverty.

income poverty at the household level, and explore the implications of these findings for rural poverty alleviation strategies in the region. Results are drawn from landholding size models using nationally-representative survey data in five countries between 1990 and 2000: Ethiopia, Kenya, Rwanda, Mozambique, and Zambia. The paper addresses three major points: (1) why geographically-based poverty reduction 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 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 (3) why meaningful poverty alleviation strategies in at least some African countries will require redressing the land constraint faced by the rural poor. This means either fundamental changes in access to land for a sizeable proportion of the rural population or growth in off-farm sectors that are able to pull many farm households out of agriculture. Realistic discussions of poverty alleviation strategies in Africa need to be grounded in the context of prevailing land distribution patterns.

## 2. CONCEPTUAL FRAMEWORK:

The model of structural transformation has demonstrated that in countries where 70-80% of the rural population derive the bulk of their income from agriculture, poverty reduction typically depend on agricultural growth.[4] There are several reasons for this. Agricultural growth puts downward pressure on the price of food, which forms a large share of the rural poor's expenditures. Agricultural growth also reduces poverty through the labor market. The rural poor tend to be the main beneficiaries of increases in agricultural wages or demand for agricultural labor. But agricultural growth's most fundamental role in poverty reduction is its forward and backward linkages with the rest of the economy. As shown in different parts of Asia by Johnston and Mellor (1961), Mellor (1976), and Gabre-Madhin and Johnston (2002), growth in non-farm sectors of the economy, most of which is non-tradable in nascent economies, must be fueled by local demand. With such a large portion of the rural population in agriculture, demand for locally-produced non-farm goods and services must be fueled largely from rising incomes from agriculture. Growth in non-agricultural sectors draws rural labor off the farm, resulting in demographic shifts from rural to urban areas, and associated changes in education and population growth. But as Mellor and Johnston stress, agricultural growth must be sufficiently broad-based to stimulate the demand for local non-farm goods and services. Because expenditure patterns of small rural households favor local non-farm goods and services, while those of wealthy landowners favor foreign goods and savings, agricultural growth must be broad-based enough to appreciably generate these growth linkages within the local economy. For these reasons, the speed of the structural transformation process is likely to be affected by the distribution of assets in the agricultural sector, particularly land.

[4] The genesis of this literature is the pioneering work of Johnston (1961); Johnston and Kilby (1975); and Mellor (1976). See also Lipton (1977); Coxhead and Warr (1991); Haggblade, Hammer and Hazel (1991); Delgado et al (1994); and Datt and Ravallion (1998).

Our conceptual framework also draws from more recent research showing that rural income growth is facilitated by a relatively egalitarian distribution of rural assets. 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. In countries with a "bad" distribution of assets, however, economic growth was skewed more toward wealthier households, causing the gap between rich and poor to widen. 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.

Discussions of feasible and sustainable rural growth strategies must be grounded within the context of prevailing farm size distribution patterns and trends. Available evidence indicates that most of Africa is facing increasing rural population densities and person-to-land ratios. FAO data since 1960 indicate that the ratio of land under crop cultivation to agricultural population (a rough proxy for farm size per capita) has been shrinking gradually but consistently in Africa. The FAO data indicate that relatively densely populated countries such as Kenya and Ethiopia have seen this ratio cut in half over the past 40 years (Table 1). And even in countries widely considered to be land abundant, such as Zambia and Mozambique, the data also show a clear trend in declining farm sizes. 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.[5]

## 3. COUNTRY DATA SETS

The agricultural household survey data sets used in this study were generally derived from national statistical agencies. In every country, the surveys are confined to smallholder farm households. This means that they were involved in some form of crop production and cropped less than some specified amount of land.[6] In no cases are large-scale farmers included in the samples.

[5] This trend does not hold in parts of Asia that have displayed the main demographic and economic features of structural transformation. See Jayne et al (2002) for empirical trends and Gabre-Madhin and Johnston (2002) for a analysis of structural transformation processes in selected Asian countries.

[6] There were some variations in decision rules employed by the various national statistical agencies. In most cases, households farming more than 10 hectares were excluded from the sample. We excluded pastoral areas in from the analyses so as to focus on income and land allocation patterns within areas where farming predominates. See Jayne et al (2002) for other procedures in defining 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 contains 2,658 households and is representative to the zone 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.[7] 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.

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, this is the only welfare indicator that was consistently available in these data sets. Despite its problems, income is generally considered to be a key indicator of household economic activity and welfare.

## 4. RURAL INCOMES: LEVELS AND DISTRIBUTION

Table 2 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 2, 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.

[7]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.

To examine the income distribution more carefully, we use two inequality measurements. First, we use the RELGAP measure of inequality, 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 0.45, while it is 0.50 in Latin America, where income inequalities are generally considered to be relatively severe. We find Gini coefficients of 0.52 for Kenya, 0.59 for Ethiopia, and 0.60 for Zambia, considerably higher than the averages for Latin America. In Rwanda and Mozambique, the Gini coefficients are slightly lower than the other two countries, but still 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 2 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.

## 5. 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 3). 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 0.05 to 0.15 for all five countries. 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 15% 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.

## 6. 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.[8] In the Eastern and Southern Africa region, the smallholder farm sector is typically characterized as small but relatively "unimodal" and equitably distributed land holdings within the framework of a "bi-modal" distribution of land between large-scale and small-scale farming sectors. Some research (e.g., Block and Foltz 1999) refers to a skewed distribution of land in many Sahelian countries. Although there have been detailed studies in Africa examining traditional tenure systems (Bruce 1993; Basset and Crummy 1993; Platteau 1996) and village case studies of rural differentiation that have included landholding assets (e.g., Hill 1968; Matlon 1981), 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.

Table 4 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.[9] As shown in Table 4, column b, average land holdings in the

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[8] Previous studies include Matlon (1979), 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.

[9] This generally includes all cropped land, wood lots, fallow land, land under tree crops, gardens and rented land. Rented land makes up an extremely small part of overall land access (generally less than 0.1 hectares per capita on average). 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 district towns. Landlessness in rural villages appears to be much lower. Yet, as

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,[10] a finding which appears to be generally true according to the trends reported in Table 1.

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 (Table 4, column c). Mean farm size figures mask great variations in land access within the smallholder sector. After ranking all smallholders by household per capita land size, and dividing them into four equal 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 control about 8-20 times more land than households in the lowest quartile. These figures already include rented land, which is marginal in most of the countries examined (see Jayne et al 2002), 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 two, suggesting significant inequalities. The Gini coefficients in column (e) also indicate a high degree of dispersion in land holdings. Given relatively homogeneous production 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.

## 7. 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? 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

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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.

[10] 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.

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 3, column d, indicate that the province variable explains only between 3 and 12 percent 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 f). In Mozambique and Rwanda, village-level effects explain less than 20% of total variation in per capita landholding sizes. The remaining (unexplained) variation is 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, sex, and age of household members, the age and education level of the household head, dummy variables for whether the household is female-headed with and without a male partner living off the farm, and the value of animal assets. If land were allocated to households according to productive assets and family size, the inclusion of these household characteristics should greatly increase the explained variation in landholding sizes. The results for the five countries are shown in Table 5.

The model results consistently show that the number of adult males and females in the household is associated with larger farm sizes and smaller farm sizes per capita. As expected, the number or small children is not associated with larger farm sizes (except in Zambia), but is significantly associated with smaller farm sizes in per capita terms. For countries where the age of the household head was available (Ethiopia and Zambia), we note a non-linear relationship between age and land access, corresponding to theories of household life cycles (Low 1986). In the case of Ethiopia, for example, households with heads that are 50 years of age have roughly 0.12 hectares more land than those with heads of 30 years old. But as the head progresses in age and loses family labor as sons and daughters leave home, mean land access declines back down to about the same levels as at age 30, other factors constant. In Zambia, Kenya, and Ethopia, female-headed (unmarried) households have, on average, 1.05, 1.03, and 0.25 hectares less land than male-headed households, which is very significant considering that mean farm sizes in these countries are only 2.76, 2.65, and 1.17 hectares. Female-headed households in which a male partner resides off-farm also tend to have less land than male-headed households, although the effect is weaker than for female-headed unmarried households, except in the case of Mozambique. Education levels of the household head is also positively correlated with access to land, again except for Mozambique, where the proportion of household heads with over eight years of education is rare. Lastly, we find very strong and typically non-linear associations between animal assets and land access, both total and per capita.

However, as statistically significant as many of these socio-demographic household characteristics are, their inclusion with village-level dummy variables in most cases provides relatively little improvement in the explained variation of the per capita land access models, over and above the models containing only village dummies. In Kenya and Ethiopia, the adjusted $R^2$

rises from 0.333 and 0.171 to 0.53 and 0.486, respectively, but in Zambia, Mozambique, and Ethiopia, the inclusion of these household covariates adds at most 0.12 to the explained variation in land access per capita.

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 about half of the variation in household land access per capita in Kenya and Rwanda, and a much higher share of the variation in land access per capita in the other three countries.

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 speculate 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.

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 1). The three dashed vertical lines show the $25^{th}$, $50^{th}$, and $75^{th}$ 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). More detailed econometric analysis is contained in Jayne et al (2002). The association between household income and land is especially steep among households whose land size is below the median level (the middle dotted line in Figure 1) 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 percent 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 percent in Rwanda, just less than 40 percent in Mozambique, and about 30 percent 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.

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.[11] We discuss alternative policy options in next section.

## 8. IMPLICATIONS FOR POVERTY REDUCTION AND ECONOMIC GROWTH STRATEGIES

The findings presented in this paper point to several basic conclusions. First, while some areas that experience significantly 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. This has implications for targeting vulnerable groups, assuming that income is the basis for targeting. 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.[12] 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. The bottom 25% of rural agricultural households are virtually landless, having access to 0.10 hectares per capita or less in each country examined.

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[11]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 Ramhato 1994.

[12] 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.

Third, aggregate trend data indicates that the ratio of arable land to agricultural population has declined steadily over the past 40 years. In Kenya, Ethiopia, and Zambia, for example, this ratio is about half as large as it was in the 1960s. These trends are consistent with the multiple year survey data from Rwanda, indicating that landholding size is declining for all strata of the rural population, with the decline being largest in absolute terms for households in the top end of the land access distribution, and being largest in percentage terms for households at the bottom end of the land access distribution.

What are the implications of recent empirical studies -- 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.

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 at the low end of the land access distribution having relatively high non-farm incomes. But the empirical record from these five countries indicates the reverse: off-farm incomes are positively correlated with landholdings per capita (Jayne et al 2002). It is difficult to interpret this as a manifestation of the structural transformation process. 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 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 2002). 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.

***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.

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**Table 1. 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 |

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

## Table 2. 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.

**Table 3. 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) | Between Province Differences (d) | Between District Differences (e) | Between Village Differences (f) |
|---|---|---|---|---|---|---|
| | % of total variation in household per capita income | | | % total variation in household land access per capita | | |
| **Kenya** | 6.4 | 14.3 | 23.5 | 7.7 | 15.9 | 33.3 |
| **Ethiopia** | 1.6 | 3.1 | 35.8 | 2.9 | 8.2 | 21.9 |
| **Rwanda** | 7.9 | 11.3 | 19.2 | 5.2 | 8.6 | 17.1 |
| **Mozambique** | 1.3 | 5.2 | 20.3 | 6.5 | 8.5 | 18.2 |
| **Zambia** | 2.1 | 5.9 | 15.5 | 7.7 | 11.4 | 21.8 |

Notes:
1. These figures are the adjusted $R^{2}$'s from regressing household per capita income on geographic categorical variables.
2. The specific administrative units used in each country for column (a) and (d); (b) and (e); and (c) and (g) were as follows:
Kenya: Province, District, village
Ethiopia: Killil, Zone, Wereda
Rwanda: Prefecture, ID, Stratefication
Mozambique: Province, District, village
Zambia: Province, District, Standard Enumeration Area

## Table 4. Smallholder Land Distribution in Selected African Countries

| Country | (a) sample size | (b) Ave. land access per hh | (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 |

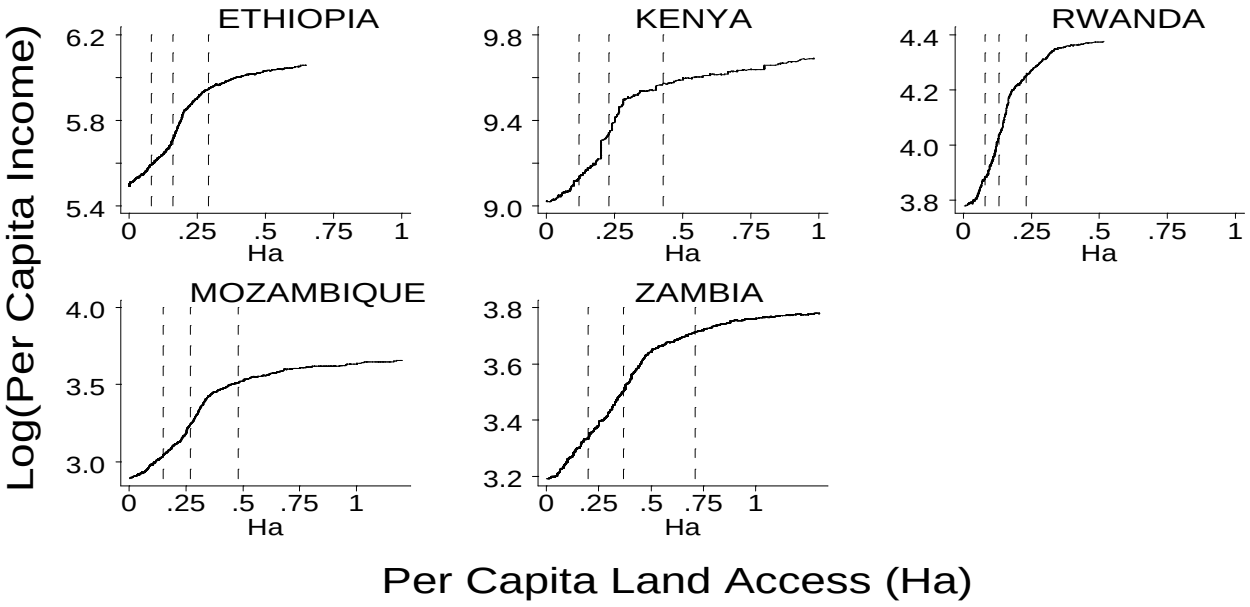
Note: Numbers for Ethiopia, Rwanda, Mozambique, and Zambia, including Gini coefficients, are weighted. Numbers for Kenya are sample statistics.
1) RELGAP is the difference in mean land size between the first and fourth quartiles divided by the mean. [3] "Profile of Poverty in Malawi, 1998," National Economic Council, Malawi, 2000.

**Table 5. Household Land Access and Land Access Per Capita Model Results: OLS Analysis**

| | Kenya | | Ethiopia | | Rwanda | | Mozambique | | Zambia | |
|---|---|---|---|---|---|---|---|---|---|---|
| | hectares | hectares per capita | hectares | hectares per capita | hectares | hectares per capita | hectares | hectares per capita | hectares | hectares per capita |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| *Head Characteristics* | | | | | | | | | | |
| Head's age | | | 0.028 | 0.007 | | | | | 0.076 | 0.017 |
| | | | (1.88)* | (2.23)** | | | | | (2.87)** | (3.06)** |
| Head's age squared | | | -2.9xE-4 | -7.2xE-5 | | | | | -3.7xE-4 | -1.1xE-4 |
| | | | (1.96)* | (2.23)** | | | | | (1.40) | (1.91)* |
| Head has some education | 0.424 | 0.013 | 0.027 | 0.006 | 0.153 | 0.044 | 0.081 | -0.132 | 0.496 | 0.081 |
| | (1.48) | (0.30) | (0.30) | (0.31) | (3.76)** | (4.30)** | (0.82) | (-0.44) | (1.91)* | (1.51) |
| Head has high education | 0.730 | 0.059 | | | | | -0.557 | -0.098 | 1.077 | 0.176 |
| | (2.76)** | (1.43) | | | | | (-2.05)** | (-1.20) | (3.81)** | (3.01)** |
| Female headed | 1.034 | 0.121 | -0.255 | -0.072 | 0.004 | -0.016 | 0.012 | 0.006 | -1.048 | -0.161 |
| | (1.85)* | (1.39) | (2.06)* | (2.63)** | (0.08) | (1.15) | (0.04) | (0.07) | (6.12)** | (4.54)** |
| Female headed, married | -0.469 | -0.101 | -0.175 | -0.059 | | | -0.297 | -0.057 | -0.608 | -0.145 |
| | (1.05) | (1.46) | (1.00) | (1.54) | | | (-2.28)** | (-1.45) | (1.95)* | (2.24)** |
| *Household Composition* | | | | | | | | | | |
| # of young children | -0.139 | -0.088 | 0.024 | -0.043 | 0.012 | -0.043 | 0.056 | -0.07 | 0.202 | -0.085 |
| | (1.56) | (6.36)** | (0.61) | (5.01)** | (0.54) | (7.97)** | (1.67) | (-7.11)** | (5.73)** | (11.7)** |
| # of boys over 6 yrs | 0.327 | -0.026 | 0.128 | -0.022 | 0.059 | -0.026 | 0.073 | -0.057 | -0.008 | -0.047 |
| | (4.36)** | (2.24)** | (2.82)** | (2.25)** | (2.60)** | (4.57)** | (1.67) | (-4.34)** | (0.07) | (2.18)** |
| # of girls over 6yrs | 0.288 | -0.030 | 0.050 | -0.030 | 0.065 | -0.021 | 0.119 | -0.056 | 0.164 | -0.035 |
| | (3.86)** | (2.61)** | (1.01) | (2.82)** | (3.07)** | (4.00)** | (2.53)** | (-3.93)** | (1.56) | (1.62) |
| # of male adults | 0.323 | -0.033 | 0.091 | -0.025 | 0.193 | -0.006 | 0.148 | -0.033 | 0.111 | -0.019 |
| | (3.98)** | (2.62)** | (1.96)* | (2.46)** | (8.74)** | (1.07) | (2.92)** | (-2.17) | (2.93)** | (2.36)** |
| # of female adults | 0.436 | -0.021 | 0.101 | -0.022 | 0.174 | -0.013 | 0.351 | -0.029 | 0.104 | -0.028 |
| | (5.21)** | (1.63) | (1.83)* | (1.80)* | (7.54)** | (2.29)** | (7.03)** | (–1.93) | (2.48)** | (3.27)** |
| *Household Characteristics* | | | | | | | | | | |
| Value of animals x 0.001 | 0.151 | 0.003 | 0.229 | 0.074 | 0.120 | 0.016 | 0.030 | 0.006 | 5.424 | 0.846 |
| | (13.8)** | (16.4)** | (1.51) | (2.22)** | (9.40)** | (4.89)** | (7.35)** | (5.22)** | (8.54)** | (6.43)** |
| Value of animals, squared | 1.9xE-7 | 3.3xE-8 | -2.4xE-4 | -5.4xE-5 | -0.002 | 0.001 | -6.8xE-5 | -1.2*E-5 | -1.1xE-3 | -1.7xE-4 |
| | (8.61)** | (9.45)** | (0.49) | (0.50) | (2.91)** | (4.08)** | (-6.81)** | (-3.80)** | (5.43)** | (4.06)** |
| Regional Fixed Effects | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Constant | -0.763 | 0.468 | -0.073 | 0.175 | 0.055 | 0.250 | 0.89 | 0.610 | -0.956 | 0.426 |
| | (2.27)** | (8.95)** | (0.22) | (2.34)** | (0.97) | (17.5)** | (1.49) | (3.36)** | (1.51) | (3.25)** |
| Number of observations | 1,441 | | 3,903 | | 1,128 | | 2,147 | | 6,921 | |
| Adjusted $R^2$ | .506 | .531 | .262 | .237 | .452 | .486 | .206 | .304 | .314 | .258 |

Note: land access defined as land under use rights plus rented land. * indicates 10 % significance level; ** indicates 5% significance level. Regional fixed effects are in terms of weredas (Ethiopia), districts (Kenya and Mozambique), census enumeration unit (Zambia), and prefecture (Mozambique).

**Figure 1. 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 percent of observations are excluded from the graphs because lines are sensitive to a few extreme cases.

## APPENDICES

### Appendix A: 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.