Determinants of poverty in rural Ethiopia

Ayalneh Bogale
Alemaya University, Ethiopia,

Konrad Hagedorn
Humboldt University of Berlin, Germany,

Benedikt Korf
University of Liverpool, UK

Abstract

This paper investigates the determinants of rural poverty in Ethiopia. Our study is based on information gathered from a three-round survey of 149 rural households in three districts of Ethiopia during the 1999/2000 cropping season. The FGT poverty index (index proposed by Foster, Greer and Thorbecke) is employed to examine the extent and severity of rural poverty. It reveals that nearly 40% of the sample households live below poverty line with an average poverty gap of 0.047. The binary logit estimates shed light on factors behind the persistence of poverty and indicates that rural poverty is strongly linked to entitlement failures understood as lack of household resource endowments to crucial assets such as land, human capital and oxen. Our findings suggest that improved targeting devices can be a useful instrument in reducing poverty, in particular to reach the poorest of the poor.

Keywords: rural poverty, livelihoods, Ethiopia

1. Introduction

By any standard, the majority of people in Ethiopia are among the poorest in the world (DERCON and KRISHNAN, 1998; IMF, 1999; RAHMATO and KIDANU, 1999; WORLD BANK, 2001). Poverty seems to persist in large sections of the rural society with little hope for a substantial improvement of the living conditions of the rural poor in the near future. In order to combat such debilitating poverty considering very scarce financial resources available to be allocated for the purpose, we have to understand the determinants of poverty in rural Ethiopia. For this, the poor must be properly identified and an index taking the intensity of poverty suffered by the poor into account needs to be constructed.

Analytical work that scrutinises poverty profiles in Ethiopia is at best scanty. Even the available ones are mostly descriptive, focusing on explaining the extent of poverty and mostly associated with studies that relate to food entitlement failures (see WEBB et al., 1992; WEBB and VON BRAUN, 1994). Among those studies, BEVAN and JOIREMAN (1997) adopt a sociological approach towards the measurement of poverty, with a focus on the meaning and use of different measurements. They emphasize that in rural Ethiopia non-economic forms of capital, such as social and human capital, are extremely important in determining life chances. More over, entitlement norms which include things as right to access to productive resources, political voice, right to leisure, inheritance rules and access to community support are crucial in determining household poverty.

DERCON and KRISHNAN (1998) assess changes in poverty levels between 1989 and 1995 and tested the robustness of measured changes to the problems of choice of poverty lines and impact of uncertainty in measured inflation rates. They found that poverty declined between 1989 and 1994 but remained virtually unchanged between 1994 and 1995 and that households with substantial human and physical capital and better access to roads and towns have both lower poverty levels and are more likely to get better off over time. They have also observed that human capital and access to roads and towns reduce the fluctuations in poverty across the seasons. Using micro-level panel data from villages in rural Ethiopia, DERCON (2001) analyses the determinants of growth and changes in poverty during the initial phases of the economic reform (1989-1995) making use of a standard decomposition of income and poverty changes. His empirical results indicate that overall, consumption grew and poverty fell substantially during the period under consideration and that on average the poor have benefited more from the reforms than the non-poor households, even though the reforms did not deliver similar benefits to all the poor. He argues that the main factors driving income changes are relative price changes, resulting in changes in the returns to land, labour, human capital and location.

The Ethiopian Ministry of Finance and Economic Development (MoFED) assessed the 1999/2000 Household Income and Consumption Expenditure (HICE) and Welfare Monitoring Survey results and concluded that the incidence of poverty is higher in rural than in urban areas with poverty head count ratio of 45.4 and 36.9%, respectively (MOFED, 2002). However, as compared to the 1995/96 level, poverty incidence increased by 11.4% in urban areas and declined by 4.42% in rural areas in 1999/2000 even though the overall poverty incidence decreased by 2.86% during the same period. Similarly, DERCON and KRISHNAN (1996) examine the income portfolios of house-holds in rural Ethiopia and Tanzania.

Most of these studies aim to assess the *extent* of poverty and explain relative changes which occur in the incidence of poverty due to, for example policy changes. This paper aims to add to the discussion by examining the socio-economic *correlates* and *determinants* of poverty in rural Ethiopia. We analyse a data set covering 149 households in three selected rural districts and estimate determinants of poverty using a maximum likelihood binary logit regression model considering whether a household is poor or non-poor as a response variable. This allows us to derive further meaningful insight about various poverty-generating factors that determine the persistence of poverty in rural Ethiopia and the relevance that specific policies can play in alleviating rural poverty. Prior to the discussion of the empirical study, we discuss the relevance of different concepts of measuring poverty, since poverty studies are difficult to compare without clarifying the various concepts of poverty measurement. We suggest a poverty measure based on household food calorie intake.

After reviewing the literature on poverty measurement, we examine household survey data from three rural regions in Ethiopia and develop an econometric analysis of the determinants of poverty (section 3). In the final section, we draw some policy implications. In particular, we argue that poverty alleviation policies need to take a broader perspective and stress the role of targeting devices as a guide to resource allocation that may improve the impact of poverty alleviation measures (section 4).

2. Methodology

2.1 Data source

The data examined in this paper came from a one-year rural household survey conducted in three rounds in three districts of Ethiopia during the 1999/2000 cropping season (BOGALE, 2002). The study has adopted a stratified random sampling procedure with rural household as an ultimate unit for acquiring first hand information. Three administrative districts, namely Alemaya, Hitosa and Merhabete, were selected purposively to represent major farming systems in Ethiopia. Alemaya is a food deficit district where rural households grow both food crops and cash crops. The households try to meet their food requirements through the combination of on-farm production and through exchange on the market place. The Hitosa district is among the high potential cereals growing areas of Ethiopia. Most rural households have the capacity to generate marketable surplus, and yield-promoting external inputs are largely used. Merhabete represents a region, which is recurrently ravaged by damaging fluctuations in climate and land degradation.

A structured survey questionnaire was designed to collect relevant information. A total of 149 households have provided complete information for the three-round survey,

from which data on demographic characteristics, crop and livestock production, household income, household consumption, and land use and management were gathered. Data on farming activities as well as returns from a total of 540 plots owned by sample households were collected. The visits were executed following a cropping calendar for the major crops in each district. The survey was conducted in three rounds (after completion of the main land preparation, completion of the final weeding, and after harvest season).

2.2 Setting the poverty line

Large literature exists on approaches to assess poverty. However, the question still remains as to where to draw the poverty line. A feature common to all approaches is a significant degree of arbitrariness in the value assigned to the poverty standard. Even with those approaches based on subsistence needs, the absence of one level of food intake required for subsistence, rather than a broad range of combinations makes constructing a suitable poverty index more complex. Ideally, the poverty line should be based on a basket of goods and services including food and nutrition, as well as clothing, housing and health care and education that can be considered basic needs (BAFFOE, 1992). GREER and THORBECKE (1986) apply the cost of food consumption corresponding to the recommended daily allowance (RDA) of calories and provide the profile and decomposition of food poverty among Kenyan smallholders.

Economic theories suggest that per capita expenditure is the best indicator of welfare, but this presupposes that households, as consumers, maximise a continuous utility function defined over commodities (GLEWWE, 1987). For the poor households, which may strive to meet their minimum target of subsistence, this assumption may not be applicable, however. Moreover, in rural economies, which are dominated by smallholder subsistence households and where institutions for smoothing consumption expenditure are not well developed, such indicators may be less reliable.

Acknowledging the complexity of poverty in subsistence economies of rural Ethiopia, BEVAN and JOIREMAN (1997) employed personal wealth ranking, community wealth ranking and consumption poverty, and concluded that none of the indicators applied identifies the poor in a convincing way.

The most popular methods of poverty measurement have used the nutritional norm and defined poverty line in terms of minimum calorie requirements (DANDEKAR and RATH, 1971; OSMANI, 1982; GREER and THOBECKE, 1986; AHMED et al., 1991; ERCELAWN, 1991; RAVALLION and BIDANI, 1994). The major problems of such an approach include determining the minimum food consumption basket that represents

the food habit of the poor, the use of value judgements and choice of an appropriate price index to deflate their current food expenditure.

Individuals having different food preferences and facing different relative prices in different regions may have the same monetary shortfall, but this may not necessarily imply the same caloric shortfall. GREER and THORBECKE (1986) further recognise the need to convert the monetary shortfall into corresponding implicit caloric deficit to measure the biological deprivation.

Taking into account the problems associated with poverty indicators, we follow the common practice in taking poverty to mean a lack of command to meet a person's typical food caloric intake just sufficient to meet a predetermined food energy requirement. Setting this predetermined food energy requirement is also not immune for problems although there are good reasons to use it. Estimates of daily per capita requirements vary widely, for instance, 2,100 kcal for Indonesia (RAVALLION and BIDANI, 1994), 2,250 kcal for Kenya (GREER and THORBECKE, 1986), 2,300 kcal for Ethiopia (DERCON and KRISHMANN, 1998); a value of 2,350 kcal is recommended by the World Bank for the study of poverty (SCHUBERT, 1994).

In the absence of an invariably acceptable national poverty line for Ethiopia, a food poverty line of meeting 2,300 kcal per person per day, a value which is the minimum energy requirement for a person to lead a "normal" physical life under Ethiopian conditions, as estimated by the Ethiopian Nutrition and Health Research Institute (EHNRI) is used for the purpose of this study. That is, a household is deemed as living in poverty if the daily per capita household food energy intake falls below 2,300 kcal. Furthermore, as is common in most food poverty studies, it is assumed that when commonly consumed cereal based diets meet the recommended daily calorie allowance, they also satisfy the major protein, vitamin and mineral needs.

Many combinations of food items could meet the requirements of 2,300 kcal. However, it is most relevant to construct a food basket based upon the actual consumption patterns of the poor in rural Ethiopia. Of course, since the poverty line has not yet been defined, one cannot know who exactly the poor are to set up the reference food bundle. In case of Indonesia, RAVALLION and BIDANI (1994) chose the mean values for the poorest 15% of the population, whereas APPLETON (1999) focused on the consumption patterns of the poorest 50% of the people, ranked by consumption per adult equivalent, in Uganda. DERCON and KRISHNAN (1998) and BIGSTEN et al. (2003) relied on a typical diet for the poorest half of the sample households in the nominal consumption to construct the reference food basket for their studies on poverty in Ethiopia.

For the purpose of this study, it is assumed that regional variations in food consumption patterns are more important than differences observed between the poor and non-poor household within a given district. Therefore, in determining the food poverty line, we used the consumption data from the household survey and relied on the general pattern of food consumption at district level to estimate the quantities of various food items consumed by rural households, which constitute the reference food basket. Using the Food Composition Table for Use in Ethiopia (EHNRI, 2000), the relevant quantities were converted into calories generated.

Since our aim is to identify a food bundle to attain the 2,300 kcal benchmark, the mean values were then scaled in the same proportion as in the reference food basket following RAVALLION and BIDANI (1994) and DERCON and KRISHMANN (1998). Meat is excluded from the food bundle, as it represents a very insignificant proportion of consumption of the rural poor households. The resulting food bundle is transferred in to monetary values in order to identify the poverty line.

Average prices obtained from each district are applied on the respective components of the food bundle to convert the metric units into monetary values in order to identify the cost associated with each poverty line. The total cost of the food bundle, our poverty line, ranges from ETB 460 per annum per capita in Merhabete to ETB 715 in Alemaya district. The total cost also allows for expenditure on variety of non-staple foods, which may help to meet nutritional needs and tastes. Non-food expenditure is also accounted for.

Of course, some problems are apparent with this approach - especially using average local prices. First, there is significant variation in the price of goods, particularly for agricultural produce, between different seasons. Coupled to that fact, obtaining appropriate prices becomes more crucial as price dispersion in rural Ethiopia is high, owing to considerable time required to perform arbitration. The very poor infrastructure also hinders the development of efficient markets to serve rural households. Therefore, relying merely on average prices can mask particularly transient seasonal poverty. Second, the approach assumes the availability of these commodities in the local market and that the local unit of measurements are standardised, which is actually difficult to believe in the real conditions of rural Ethiopia. In this regard, CAPEAU and DERCON (1998) appreciate the problem associated with local units of measurement and argue that the conclusions about poverty changes over time are significantly affected by using less appropriate strategies to convert local units and to value subsistence consumption. They illustrated how to obtain more reliable prices and conversion factors when constructing income or consumption values in Ethiopia employing an econometric approach. In order to estimate the cost of basic needs, the non-food component is simply estimated using the common practice of dividing the

food poverty line in each district by the average food share of the households that had failed to attain a food consumption level equal to the food poverty line.

Another imminent problem in setting the poverty line is the issue of family size and composition and the resulting economies of scale in consumption. The most frequent scales to express household calorie consumption are "per equivalent", "per capita" and "per adult equivalent" based on more or less elaborate weighing schemes or equivalent scale (DEATON and MUELLBAUER, 1980; LIPTON and RAVALLION, 1995). Since per capita values are extensively used in most national or regional figures, we have opted to compute per capita estimates.

2.3 The empirical model

2.3.1 Measurement and decomposition of poverty

SEN (1976) introduced an axiomatically based characterisation of the poor. Accordingly, he formulated two desirable properties of poverty indices: the monotonity axiom, which requires a rise in overall poverty level if income of a poor person is reduced; and the transfer axiom, which demands an increase in poverty whenever a pure transfer is made from a poor person to someone with more income. However, due to its link to the Gini coefficient the index is not decomposable, limiting its application (FOSTER and SHORROCK, 1991). Moreover, the index is not replicable, so its value will change if two or more identical population are merged; and it fails to satisfy the transfer axiom (SHORROCK, 1995). Since then, however, several indices of poverty have emerged, which differ with regard to the assumptions made and consequently with respect to the welfare function implied by them. The index proposed by FOSTER, GREER and THORBECKE (FGT) introduced an additively decomposable indicator of "aversion of poverty" (FOSTER, GREER and THORBACKE, 1984). The index implicitly regards misery suffered by the poor depending on the distance between a poor household's actual income and the poverty line, not on the number of households that lie between a given household and the poverty line. Thus, FGT is based on calculations of poverty measures taking income shortfalls of the poor themselves as weights. It has been used to investigate the problem of food poverty profiles as basic dimension of poverty in Kenya (GREER and THORBACKE, 1986) and in the context of Bangladesh (AHMED et al., 1991), Indonesia (RAVALLION and BIDANI, 1994) and Ethiopia (BIGSTEN et al., 2003).

In our study, we therefore apply the FOSTER, GREER and THORBECKE (1984), FGT, class of poverty index. Given a vector of suitable measure of well-being, *Y,* in increasing order, $Y_1, Y_2, Y_3,..., Yn$, where *n* represents the number of households under consideration, the FGT poverty index (P_α) can be expressed as (BAFFOE, 1992):

$$(1) \qquad P_\alpha = \frac{1}{n}\sum_{i=1}^{q}(g_i / z)^\alpha$$

Where z is the poverty line, q is the number of the poor, g_i is the shortfall in the chosen indicator of well-being. If, for instance, x_i denotes the per capita calorie intake of household i, then $g_i = z_i - x_i$ if $x_i < z$; $g_i = 0$ if $x_i \geq z$, and α is the poverty aversion parameter ($\alpha \geq 0$).

The parameter α represents the weight attached to a gain by the poorest. The commonly used values of α are 0, 1, and 2. When we set α equal to 0, equation (1) is reduced to the headcount ratio, which measures the incidence of poverty or head count ratio. When we set α equal to 1, we obtain P_1 or the poverty gap. P_1 takes into account how far the poor, on average, are below the poverty line. Setting α equal to 2 gives the severity of poverty or FGT(2) index. This poverty index gives greater emphasis to the poorest of the poor, as it is more sensitive to redistribution among the poor.

2.3.2 The probability of being poor

To characterise the poor in the study areas, a probability model is used in which the chances of falling below the poverty line are linked to household and geographical characteristics, which may at the same time be poverty generating factors.

Given the dependent variable of main interest that a household may be classified as poor or non-poor, a binary logit model can be used for the analysis of the data. Consider that a household is poor (Y=1) if per capita household food consumption is less than 2,300 kcal per day or non-poor (Y=0) if the food consumption shortfall is less than or equal to zero. A set of factors, mentioned elsewhere, gathered in a vector X, could explain the response so that:

$$(2) \qquad Y_i^* = X'_i\beta + u_i$$

where Y_i^* is the underlying latent variable that indexes the measure of poverty, u_i is the stochastic error term, and β is a column vector of parameters to be estimated. Following GREENE (1993) and assuming that the cumulative distribution of u_i is logistic, a logit model is employed. In this case, the probability of being poor can be given by:

$$(3) \qquad P(Y_i = 1) = \frac{\exp(X_i'\beta)}{1 + \exp(X_i'\beta)}$$

If we let X_{ik} be the *k*th element of the vector independent variable X_i, and β_k be the *k*th element of β, then the marginal effect of a particular independent variable, X_i, on the probability of the occurrence of the response is given by (MADDALA, 1993):

$$\frac{\partial P(Yi=1)}{\partial X_i'} = \frac{\exp(X_i'\beta)}{\left[1+\exp(X_i'\beta)\right]}\beta_k \quad (4)$$

Unlike linear models in which the marginal effects are constant, in the case of logit models, we need to calculate them at different levels of the explanatory variables to get an idea of the range of variation of the resulting changes in the probabilities.

3. Empirical results and discussion

3.1 Poverty profile

Despite the general acceptance of poverty as a multi-dimensional concept, households in poverty differ from the non-poor households in several identifiable ways. In many cases, those differences are poverty-generating factors. When the objective of poverty analysis is to discover the characteristics of the poor, one looks at statistical correlates of the poor in order to design programs that take into account their constraints and attributes. Table 1 is to facilitate comparison of some important characteristics of the poor and the non-poor households, classified based on direct calorie intake, with the overall sample. On average, in comparison to the non-poor, poor households tend to be younger by 2.70 years, have larger dependent ratio (27.50%), are less educated, have less access to land and have less number of livestock wealth at their disposal.

It is evidence from table 1 that the poor households, on average, spend only 72% of the over all average per capita consumption expenditure and 60% of the average per capita expenditure of the non-poor households. At the same time, unfavourable family composition and lower resource endowment have depressed the per capita household income of the poor more. The combination of young parents with low education is likely to be a handicap over the household's entire life cycle and results in lower earning capacity for the poor families. Accordingly, the non-poor have an average per capita household income 1.64 times higher than the average income of the poor. At this stage, a female head, without other considerations to family composition, does not appear to be a characteristic that distinguishably identifies the poor households.

As saving and credit facilities are sparse in Ethiopia, livestock remains the major saving and investment possibility in rural areas. This aspect is also justified by the fact that livestock can be kept without substantial labour input, enables productive use of child labour and provides employment during the slack period. Every household

endeavours, by keeping livestock, to enlarge its holding continuously, if possible. Therefore, it appears that the better-off farming households are distinguished by keeping larger numbers of livestock, an average of 4.30 TLU as compared to the poor households which own only 3.02 TLU. In addition to their productive functions, livestock also provide security for the misfortunes of life. At the same time, they pay dividends in the form of offspring.

Table 1. Variable definition and characteristics of sample households

Variable	Variable definition	Poor households (n = 58)		Non-poor households (n = 91)		Overall (n = 149)	
		Mean	CV(%)	Mean	CV(%)	Mean	CV(%)
Age	Age of household head in years	40.34	25.78	43.05	22.51	41.9[a]	24.30
Dep	Dependency ratio	1.53	45.10	1.2	57.50	1.33[c]	53.38
Educ	Education of household head (scaled 1 – 4)	0.67	128.36	2.12	56.13	1.56[c]	82.05
Exp	Per capita household expenditure (ETB/year)	459	33.12	750	28.67	637[c]	37.52
Sex	Sex of household head (Male=1)	0.91	---	0.88	---	0.89	---
HAE	Household size in adult equivalent	5.67	30.69	4.87	37.17	5.18[c]	35.14
HHS	Household size in number	7.34	30.79	6.18	36.25	6.64[c]	34.94
PCI	Per capita household income (ETB/year)	528	49.81	866	45.96	734[c]	52.72
TLH	Total land owned in hectares	1.46	40.41	2.25	50.22	1.94[c]	53.09
LMR	Land holding per adult equivalent	0.2	35.00	0.38	44.74	0.31[c]	51.61
Kcal	Actual household food energy consumption per capita	2024	10.62	2672	10.93	2420[c]	17.02
TLU	Total livestock holding (TLU)	3.02	2.01	4.30	2.83	3.80[c]	2.61
Ox	Number of oxen owned	0.89	9.10	1.97	52.79	1.55[c]	70.32

Note: a, b and c means the difference between averages of poor and non-poor households is statistically significance at 0.1, 0.05 and 0.01 level, respectively.

Educ: 1 = illiterate 2 = read and write or grade 3
3 = completed elementary school 4 = completed secondary school

Source: own household survey 1999/2000 (BOGALE, 2002)

This section examines the extent of poverty across the districts under consideration employing the three most common indices, namely: the incidence of poverty (head count ratio), the poverty gap and severity of poverty (FGT(2)). The incidence of poverty using both per capita household calorie consumption and per capita household expenditure to meet the cost of basic needs criteria is presented in table 2. The results indicate that 38% and 43% of the sample households are deemed poor using the former and the alternative criteria, respectively. Regional comparison of incidence of poverty employing the former criteria shows that the proportion of households living in poverty is markedly the highest in Merhabete. Applying the alternative criteria, though showing a varying impact on the head count index, did not reveal any change in ranking of districts.

Table 2. Poverty incidence and severity

District	Head count index		Poverty gap		FGT(2) index	
	Food energy consumption	Cost of basic needs	Food energy consumption	Cost of basic needs	Food energy consumption	Cost of basic needs
Alemaya	0.30	0.35	0.0305	0.0353	0.0086	0.0074
Hitosa	0.12	0.24	0.0127	0.0352	0.0027	0.0098
Merhabete	0.68	0.66	0.0891	0.1368	0.0148	0.0340
Overall	0.38	0.43	0.0466	0.0734	0.0089	0.0182

Source: own household survey 1999/2000 (BOGALE, 2002)

The poverty gap reflects the total deficit of all the poor households relative to the poverty line (RAVALLION and BIDANI, 1994). It is, therefore, a much more powerful measure than the head count ratio because it takes into account the distribution of the poor below the poverty line. It also reflects the per capita cost of eliminating poverty. The results from the survey reveal that, using both criteria, the depth of poverty is higher in Merhabete, followed by Alemaya and Hitosa, implying that more resource is required to bring the poor households out of poverty in Merhabete than Alemaya and Hitosa. An overall poverty depth of 0.0466 means that if the country could mobilise resources equal to the 4.66% of the poverty line for every individual and distributes these resources to the poor in the amount needed so as to bring each individual up to the poverty line, then at least in theory, poverty could be eliminated.

Among the advantages of the FGT poverty index is its decomposability which makes it possible to investigate the severity of poverty in more detail. From table 3, we can deduce that if appropriate measures are undertaken to fight and ultimately eliminate poverty in Alemaya, Hitosa and Merhabete districts, then poverty severity would be reduced by 27.74, 9.98 and 62.25%, respectively. The results also show that poverty is

not only most severe in Merhabete district, but there is also a very high geographical concentration of the poor in the district as 65.5% of the poor households in the sample reside there.

Table 3. Geographical concentration and average consumption shortfall of the poor

District	Contribution to poverty (%)	Concentration of the poor
Alemaya	27.74	24.14
Hitosa	9.98	10.34
Merhabete	62.25	65.51
All households	---	----

Source: own household survey 1999/2000 (BOGALE, 2002)

The decomposability property of the FGT index also allows us to construct table 4, which reflects the severity of poverty among the poor and also shows important policy implications. The numerical results suggest that the severity of poverty is more intense at the lowest decile.

Table 4. Decomposition of severity of poverty by decile

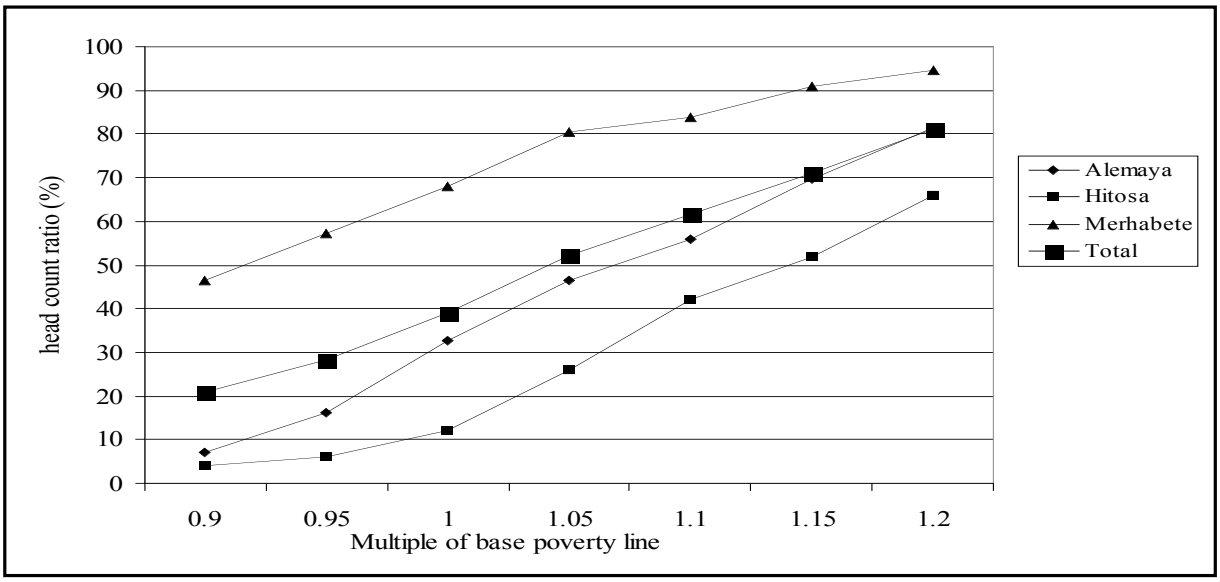
Cumulative percentage of poor households	Severity of poverty (FGT2) for the respective decile	Percent contribution to poverty
10	0.0109	47.08
20	0.0048	67.90
30	0.0024	78.65
40	0.0020	87.02
50	0.0015	93.42
60	0.0008	97.22
70	0.0004	99.02
80	0.0002	99.82
90	0.00003	99.94

Source: own household survey 1999/2000 (BOGALE, 2002)

More precisely, the results in table 4 imply that, for instance, if the bottom 30% of the poor households are correctly identified and made non-poor, then poverty severity will be decreased by 78.65%, while severity of poverty will decline only by 1% if the top 30% of the poor are to benefit from poverty reduction programmes. Therefore, poverty has become sever for the poorest of the poor and appropriate targeting of a specific segment of the poor households will have its own payoff.

Given the arbitrariness in defining the poverty line, it will be of paramount importance to apprehend how the incidence of poverty varies across the regions under consideration as assumptions regarding the original poverty line change. Figure 1 illustrates how incidence of poverty changes as multiples of the original poverty line are considered. It is possible to observe that a combination of changes in factors which may result in an increase in original poverty line only by 10% would bring 42%, 56% and 84% of the households in Hitosa, Alemaya and Merhabete, respectively, to poverty where as the overall poverty incidence increases to 62%. More over, large segment of the population appears to be concentrated close to the poverty line, as more than 71% of the households have food energy consumption less than 1.15 times the original poverty line.

Figure 1. Incidence of poverty due to change in poverty line



Source: own household survey 1999/2000 (BOGALE, 2002)

3.2 The determinants of poverty

Table 5 regresses the binary response variable, the probability of being poor (P(Y=1)). A glance at the results verifies that most of the explanatory variables in the model have the signs that conform to our prior expectations. It is also evident that most of the variables are statistically significant at 10% or lower level. Employing both criteria, the results from the pooled data across regions highlight the importance of household resource endowment in determining poverty. Land holding per adult equivalent and ownership of oxen are both significant in determining the probability of a household to be poor. Household characteristics such as household size and composition have the

desired signs but their effect is not found to be statistically significant. This weak association reflects the fact that in rural Ethiopia children, even at the age of six years, contribute to the household labour force and so to its production capacity. Looking after livestock and participating in weeding are among the prime activities of boys; whereas fetching water and fuel wood gathering are among the traditional responsibilities of girls.

Table 5. Binary logit coefficient estimates for determinants of poverty

Variable	Food calorie intake		Costs of basic needs	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Age of household head (Age)	-0.13 *	0.075	0.02	0.034
Dummy for Alemaya	-9.49 **	4.856	-7.46 ***	1.765
Dummy for Hitosa	-7.78 **	3.535	-3.17 ***	1.056
Dependency ratio (Dep)	0.34	0.732	0.58	0.483
Education of head (Educ)	-2.64 *	1.438	-1.55 ***	0.485
Per capita expenditure (Exp)	-0.008	0.008	---	---
Dummy for sex (Male=1)	2.38 ***	0.760	-1.33	1.001
Household size (HHS)	0.46	0.339	0.36 *	0.185
Per capita income (PCI)	-0.016 **	0.007	-0.015 ***	0.006
Land holding per AE (LMR)	-22.12 **	9.399	-8.72 **	4.275
Number of oxen owned (Ox)	-1.88 *	1.12	-1.84 ***	0.607
Constant	34.33 ***	13.55	6.74 ***	2.827
-2 log Likelihood	128.42		60.73	
Percent correctly predicted	95.30%		91.95	

Note: *, ** and *** indicate that the coefficients are statistically significant at 0.1, 0.05 and 0.01 level.
Source: calculated from own household survey 1999/2000 (BOGALE, 2002)

The probability of a household being poor tends to diminish as age of the household head increases using per capita household calorie consumption. This can be explained by firstly, that asset ownership tends to increase with age; and secondly, the composition of the family changes in time, as those children grow up and either can contribute labour force to various farm activities or leave the household. But note that the sign of the coefficient corresponding to age of household changes when per capita household expenditure is considered to define the poverty line and used as a response variable in the logit model implying that aged household heads have less to spend on household consumption.

The coefficient associated with gender of the household head, apparent in table 3, could be worth mentioning, given the standard presumptions. While the probability of

being poor for male-headed households is higher than the female-headed households employing the per capita food energy consumption, female-headed households have higher incidence of poverty if household consumption expenditure is considered as a criterion, although the coefficient is not statistically significant ($P > 0.10$) in the latter case. That means, male-headed households have better capacity to comply with the minimum consumption expenditure required to meet the requirements, but fail to realise it in terms of actual food consumption. In other words, given other characteristics of households, female-headed households allocate their available resources in such a way as to obtain more calories per capita than their counterpart male-headed households.

The coefficient on education reflects the prime role that human capital plays in determining poverty. In fact, education is an important dimension of poverty itself, when poverty is broadly defined to include shortage of capabilities and knowledge deprivation. It has important effects on the poor children's chance to escape from poverty in their adult age and plays a catalytic role for those who are most likely to be poor, particularly those households living in rural communities. Education is expected to lead to increased earning potential and to improve occupational and geographic mobility of labour. Therefore, it deserves an important place in formulating poverty reduction strategies.

A more appealing interpretation of parameter estimates in a logit model is explaining the marginal effect of each exogenous variable. A possible interpretation of the results presented in table 6 is that, for instance, it is expected that an additional year for the head of household (as a proxy for experience in farming), all other variables held at their mean values, decreases the probability of a household to be poor by about 0.28%. Similarly, promoting the household head by one level of education will reduce the risk of poverty by nearly 6%.

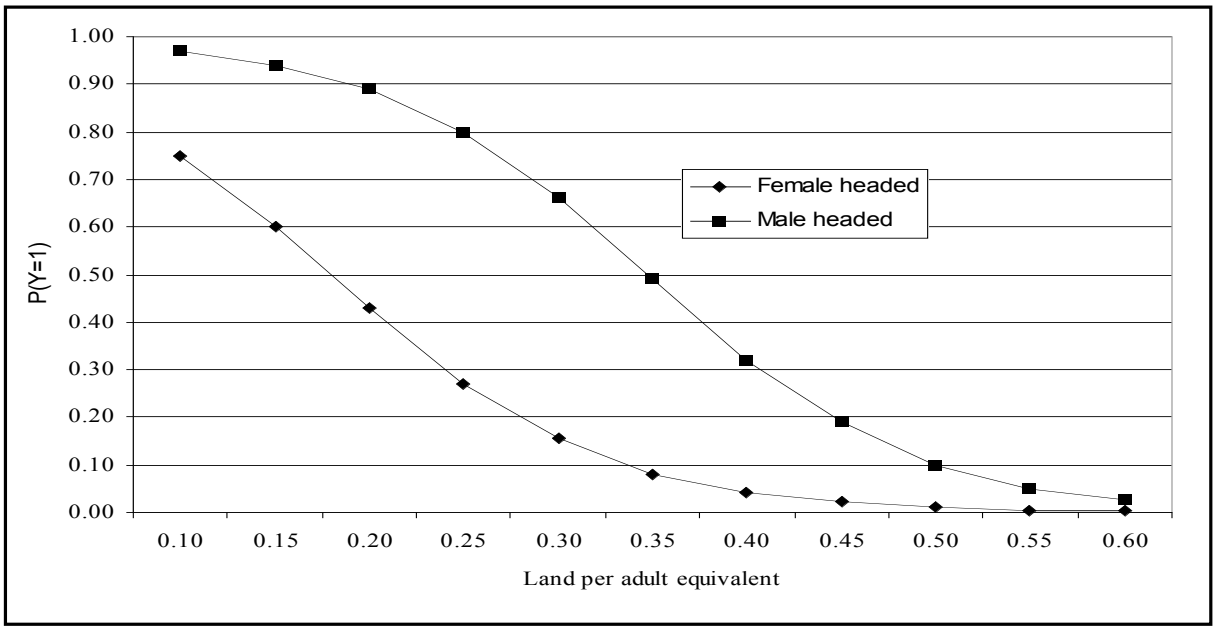
Table 6. The probability of being poor, marginal effect at mean values (percent)

Explanatory variables	Marginal effect
Age of household head in years (Age)	-0.28
Dependency ratio (Dep)	0.76
Education of household head (Educ)	-5.89
Dummy for sex of household head (Male=1)	5.32
Household size in number (HHS)	1.02
Land holding per adult equivalent (LMR)	-49.43
Number of oxen owned (Ox)	-4.19

Source: calculated from own household survey 1999/2000 (BOGALE, 2002)

Since our application of the logit model contains some dummy explanatory variables, their respective marginal effects may not be meaningful straight forward (GREENE, 1993). The marginal effects suggested so far generally produce a reasonable approximation to the change in the probability of being poor at a point, such as the mean of the exogenous variable. But at the same time, the mean value of a dummy variable may sometimes be meaningless (for instance, a gender of 0.89). In such circumstances, it is possible to analyse the marginal effect of a dummy variable on the whole distribution by computing the probability of the occurrence of the response.

Figure 2. The effect of LMR on the probability of being poor



Source: calculated from own household survey 1999/2000 (BOGALE, 2002)

Thus, a further illustrative approach to examine parameter estimates in a binary logit model is to assign differing values to a given target characteristic and simulate the resulting probability of being poor while maintaining all other exogenous variables at their mean values. In this context, it is possible to talk about the probability of being poor for a given factor, and comparison can be made across characteristics. This simulation approach is probably the most fruitful in analysing characteristics that allow for higher degree of differentiation.

Figure 2 illustrates how the probability of being poor varies for male-headed and female-headed households over a range of ownership of cultivated land per adult equivalent (LMR) using per capita household calorie consumption as a criterion. At any level of LMR, the marginal effect of gender is given by the vertical distance

between the two lines, which ranges from 0.02 at LMR of 0.60 ha to about 0.53 at LMR of 0.25 ha. That is, setting all other exogenous variables at their mean values, and given that cultivated landholding per adult equivalent is 0.25 ha, then households whose head were male were more than 50% more likely to be poor than those households headed by female.

4. Policy implications

The empirical results of this study reflect the severe poverty level that continues to prevail in rural Ethiopia, as is also documented in other research studies cited above. Even though the head count ratio, depth and severity of poverty have shown variation based on the criteria employed, all confirm that poverty is a problem of major concern. In our study, the marginal effect analysis of the exogenous variables revealed that, among others, cultivated land per adult equivalent, geographical location, education and oxen ownership are important determinants for rural poverty in Ethiopia. These findings indicate that poverty is best understood as a lack of household resource endowments, which means that households are deprived from basic livelihood assets. In addition, the study shows that it is important to differentiate *among* poor and that attention needs to be paid to the poorest of the poor.

The results provide meaningful insight about various poverty-generating factors and the relevance of various policies. We argue in this paper that targeting is an essential instrument to achieve a better impact of poverty alleviation measures. Our research results imply that poverty is to some extent explained by disparities among regions in terms of lack of adequate infrastructure and resource degradation. Reducing poverty could therefore be more effective with geographic targeting. This can help improve the design of poverty alleviation programs and determine the ways in which a budget can be distributed so as to maximise poverty reduction. Similarly, targeting within communities is important in view of the fact that the poorest of the poor need to be identified and specifically supported. Our results indicate that uplifting the livelihoods of the poorest of the poor can contribute significantly to reduce overall poverty: if the bottom 30% of the poor households were correctly identified and made non-poor, then, in our sample, poverty severity would decrease by 78.65% (see above).

Our results also suggest implications for gender policies. The simulation of probability estimates showed that, given other characteristics of households, female-headed households allocate their available resources in such a way as to obtain more calories per capita than their counterpart male-headed households. Hence, supporting female headed households to overcome poverty will most probably yield better results in terms of improving the nutritional status of households. In addition, if programmes

promote action that ensures a greater access of women to assets, education and participation in decision-making, this may contribute to improve intra-household resource allocation towards food security.

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Corresponding author:
Benedikt Korf
Department of Geography, University of Liverpool, Liverpool L69 3BX, UK
phone: +(44)-151-79 42 840 fax: +(44)-151-79 42 866 email: b.korf@liv.ac.uk