Analysis of poverty and its covariates among smallholder farmers in the eastern Hararghe highlands of Ethiopia

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1. Introduction

Ethiopia is undoubtedly among the poorest nations in the World. The most recent World Development Report 2007 calculated a per capita income of US$ 160 (World Bank, 2007), and in the Human Development Index (HDI), Ethiopia has been ranked 170th out of 177 nations with HDI value of 0.371(UNDP, 2006). Poverty has persisted even during the comparatively stable political period since the downfall of the so-called *derg* regime in 1991. While, on an aggregate scale, poverty seems to persist at debilitating levels, this does not say much about the location specific extent and determinants of poverty. Several questions become important here: the intensity of poverty, its *dynamics* over time (Sahn and Stifel, 2000; Bigsten et al., 2003; Dercon, 2006), including the question of chronic poverty (Barrett et al., 2006; Hulme and Shepherd, 2003) and poverty traps (Barrett and Swallow, 2006), and the different demographic, socio-economic and institutional factors that explain the incidence of poverty.

A number of studies have sought to examine the *extent* of poverty in rural Ethiopia. The government's 2004/05 Household Income and Consumption Expenditure Survey is the most extensive survey available on the *extent* of poverty. It indicates that the incidence of poverty is higher in rural compared to urban areas with the poverty head count ratio being 39.3% and 35.1% respectively. The survey also revealed that national poverty incidence has declined by 12% as compared to the 1999/2000 level (MoFED, 2006). Dercon and Krishnan (1998) have assessed changes in poverty level between 1989 and 1995 and tested the robustness of measured changes to the problems of the choice of poverty lines and impact of uncertainty in measured inflation rates. They found that poverty declined between 1989 and 1994, but remained unchanged between 1994 and 1995. Dercon (2006) confirms the fall in poverty over the same period and shows an increase in consumption levels. He identifies relative price changes – affecting returns on labor, land, human capital and location - as main driving factor in income levels.

Bigsten et al (2003), Sharp and Devereux (2004), Dercon et al (2005) and Little et al. (2006) study the *dynamics* of poverty and consumption levels and emphasize the role of shocks in influencing fluctuations in consumption levels over relatively short periods of time.

Dercon et al (2005) studied consumption levels in 15 Ethiopian villages in the period of 1999-2004 and found that virtually all households experienced adverse effects of shocks, among which they enumerate drought and illness as most important. The former reduced consumption levels in the sample by 20% and the latter by 9%. Policy shocks, such as risk of land distribution or arbitrary taxation were found to be less significant – a change compared to earlier studies conducted (Dercon, 2001). Investigating poverty dynamics in South Wollo between 1997 and 2003 (including the 1999/2000 drought), Little et al. (2006) found that the incidence of poverty in their survey area changed little, but the very poorest improved their welfare a lot, though not sufficiently to escape poverty.

Researches on *factors* that affect incidence of rural poverty in Ethiopia have indicated that entitlement failures are key in explaining low consumption levels (Bevan and Joireman, 1997; Webb et al., 1992; Webb and von Braun., 1994; Bigsten et al., 2003). Bogale et al. (2005) found that cultivated land per adult equivalent, geographical location, education and oxen ownership to be important determinants of rural poverty. Bevan and Joireman (1997) emphasize the important role of non-economic forms of capital, such as social and human capital as well as entitlement rules, such as access rights to productive resources, political voice, inheritance rules and access to community support in determining household poverty. Sharp and Devereux (2004) found that destitute households in Wollo region of Ethiopia face constrained access to land, labor, livestock, social networks and transfers. Dercon and Krishnan (1998)'s survey results indicated that households with better human and social capital as well as better access to roads and towns have both, lower poverty levels, are more likely to improve their poverty status over time and are less prone to seasonal fluctuations in welfare. Education was also found to be a central factor: Weir and Knight (2004) found significant externality benefits of schooling in lifting up agricultural productivity, but they did not compare this with household consumption levels.

Devereux and Sharp (2006) question the validity of some of the above findings on the basis of the methodological foundations of the data up on which poverty trends and determinants are derived and the conceptual understanding of poverty itself. Moreover, they argue that the use of uniform national poverty line used to define the poor and the non-poor may camouflage the significant regional variations one can observe within the nation. Location specific, methodologically comparable and disaggregated studies need to complement findings from large-scale panel data employed in the government's Household

Income and Expenditure Survey (MoFED 2006) and the panel data collected by Addis Ababa University (Bigsten et al 2003).

This paper provides a disaggregated household survey and studies household and community level covariates that affect the probability of a rural household to be poor (on various levels of poverty or deprivation) at a particular time. The study is based on a survey of 216 households in three districts in the eastern Hararghe highland using the Eastern Hararghe highlands of Ethiopia using a household expenditure approach. Eastern Hararghe highlands are characterized by more intensive, but small-scale farmland holdings producing largely for the market with cash crops, e.g. *khat*, constituting an important part in the landscape. These characteristics differ from the Tigray and Wollo regions where much more research on poverty and exclusion has been conducted and where extreme poverty, recurrent famine and drought related problems are more persistent than in our study region. The results therefore provide an important complementary insight to the research discussed above.

2. Data

The analysis of poverty in this paper is based on a household survey conducted in three districts in eastern Ethiopia in the period of 2003/2004. The three districts, namely Babile, Kersa and Kombolcha were selected purposively to capture agro-ecological, economic and social diversities within the eastern Hararghe highlands. That was followed by two-stage random sampling procedure. In the first stage four, two and three peasant associations (PAs) were selected randomly from a list of PAs in the district of Babile, Kersa and Kombolcha, respectively. In the second stage, sample households were randomly drawn from a complete list of respective PA members in conformity with the proportionate to size random sampling procedure. In total, the survey covered 216 households. Generally being located in different districts, the sample households display interesting regional variation even within the region.

3. Analysis of household poverty

The analysis in this section is based on the expenditure dataset of the sample households. Household expenditure is considered as an adequate measure of household welfare in developing countries as it is better able to capture household's consumption capabilities (Grootaert, 1986). Accordingly, a household is considered as poor when household expenditure is insufficient to meet the food and other basic needs of all household members. To make the assessment, a basket of goods and services corresponding with local

consumption patterns and satisfying a pre-set level of basic needs for one person is constructed and valued at local consumer prices to compute its minimum cost. The value of this basket is called the "poverty line", and is most appropriate if expressed in per-adult equivalent terms (Lipton and Ravallion, 1995). Even though the data requirements of this method are considerable, and very comprehensive questionnaires are needed to collect it, it remains to be a widely accepted measure of poverty—as far as its economic dimension is concerned. In this study too, household expenditure on basic needs - including those on food, clothing, housing, education and medical care-estimated to be ETB[1] 1468.00 per adult per annum was used as poverty line.

In this study, we follow the Foster, Greer and Thorbecke (Foster et al., 1984) class of poverty index to scrutinize the extent of poverty at the household level. Let us begin with some notations. Define a vector of a suitable measure of living standards *Y* (household calorie intake per capita, or expenditure) in increasing order, $Y_1, Y_2, Y_3, \ldots, Y_n$, where *n* represents the number of households under consideration. The General Foster, Greer and Thorbecke (FGT) poverty index (P_α) can be expressed as:

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

where: x represents income; z is the poverty line; q is the number of the poor; gi is shortfall in chosen indicator of standard of living, say expenditure per capita shortfall of the i-th household. That is, let xi denote the per capita expenditure of household i, then gi =z-xi if xi $<$ z ; gi = 0 if xi $\geq$ z. α represents poverty aversion parameter (measure with larger α are more sensitive to the poorest of the poor. For $\alpha = 0$, Pα will be equal to the poverty headcount ratio; for $\alpha = 1$, Pα will be equal to the normalized poverty gap and for $\alpha = 2$, Pα will be equal to the squared normalized poverty gap ratio.

Based on the poverty line estimated earlier, the analysis undertaken for the whole sample households yields a poverty head count ratio of 0.356, that is, 35.6% of the total population spends less than what they would need to meet minimum living standard requirements. By decomposing across districts, we observe a differentiated picture of the distribution of poverty. Table 1 depicts that a high proportion (52.3%) of the population in Babile district live below the poverty line followed by Kombolcha district with head count

[1] US$ 1 = ETB 8.67 at the time of the survey

ratio of 0.301. The results with respect to the depth of poverty and severity of poverty also show that both the depth and severity of poverty seem to be highest in districts with highest incidence of poverty. One can observe that not only is the incidence of poverty in Babile district the highest, almost three times that of Kersa and two times that of Kombolcha, but also poverty in Babile is found to be deeper and more severe.

<<Table 1 about here>>

4. Covariates of rural poverty

While economic theory provides a well-developed framework for studying earnings and income, no similar and uniform theory exists that could guide us in the more complicated case of poverty analysis (Bigsten et al., 2003; Barrett and Swallow 2006; Glauben et al., 2006; Dercon, 2006). In principle a whole variety of factors could be considered as important determinants of lifetime poverty, among those are: age, human capital (formal or informal education), sex of household head, household size, and resource endowment. Table 2 presents code, definitions and descriptive statistics of variables considered in this study.

<<Table 2 about here>>

A particular interest in our study is the role of active membership in or effective access to (the benefits of) various types of local level organizations and networks – often referred to as "social capital" (Putnam 1993; Woolcock and Narayam 2000; Donnelly-Roark et al. 2001; Grootaert and Van Basteler 2002) - as a covariate to household poverty. We defined "active membership" as having a decision making power and regularly contributing to social obligations defined by an organisational structure (e.g. payments, attending meetings, participation in elections, number of days participated in food for work of employment generation schemes). Of course, this is only a proxy of the real decision making power an individual disposes off in a specific organisational structure that is also influenced by informal power plays.

We have differentiated local-level organisations and networks into three types, namely (a) governance and administrative networks (GALLI), e.g. involvement in peasant organizations, (b) social and religious (SRLLI) and (c) natural resource and productive networks and organizations (NPLLI), e.g. involvement in networks of labour exchange). GALLI mainly refers to the formal and informal local governmental set-up of peasant associations (*kebeles*) with their council, executive council and tribunal. Furthermore, the regional government of Oromiya has recently introduced a set of quasi-governmental

organisations below the *kebele* level, e.g. the *gott*, which is considered a voluntary association of farmers encompassing between sixty to ninety households. *Gott* can be further sub-divided into *garee* or *misoma*. In addition, there are traditional institutions, such as the village leader (*aba genda*) and council of elders (*jarsota*), who mediate in minor social conflicts. SRLLI encompasses mainly informal institutions and organisations, mostly linked with Islam, that offer mutual aid and religious dealings, as well as those religious organisations dealing with education and health. These include, among others, *sedeka* and the *imam*. Secondly, it takes account of voluntary associations, such as *afosha* (burial societies), *uqqubii* (mutual assistance, savings) as well as *iddirii* or *mandar*. NPLLI comprises formal and informal institutions dealing with the productive affairs of the community and includes customary organisations and practices of labour exchange (*guza, maro, garre, uqqubi*), herding groups among agro-pastoralists as well as NGO driven organisations and practices for soil and water conservation, including food-for work programmes. We anticipate that very poor, poor and non-poor will have differential access to and will participate differently in each of these forms of organisations and networks.

4.1. The empirical model

Three crucial methodological issues are involved in the analysis of poverty: the first one relates to the problem of determining an appropriate poverty line and thus identifying those who are classified as poor, the second one relates to the problem of constructing a suitable overall index of poverty, and the third one relates to identification of the proper econometric model to analyse the correlates of poverty. The standard tools for assessing the correlates of poverty are multivariate consumption expenditure regressions (World Bank, 2000). These regressions can also estimate the partial correlation coefficients between consumption expenditure per adult equivalent and the included explanatory variables.

An alternative to exploring the correlates of poverty by using per adult equivalent consumption expenditure as the endogenous variable is to perform categorical data analysis such as Probit, Logit or Tobit. Such response models are often used when a dependent variable takes one of a number of discrete values and simulations can conveniently demonstrate how much the likelihood of being poor is reduced if an exogenous variable such land ownership were to change (Bogale et al., 2005). These models estimate the probabilities of being poor using Maximum Likelihood Estimation (MLE) while accounting for the discrete nature of the dependent variable (Greene, 2002). Binary response models (e.g. probit, logit) are used where poverty is considered as a “yes” or “no” decision. However, in this

study we do not only consider whether a household is poor or not, but also the intensity or depth of poverty. Therefore, the model needs to consider more than two possible responses. Similar approach has been followed by Alemayehu et al. (2001). They focus attention on the hard-core poor, moderately poor and non-poor categories to employ an ordered logit model. This approach is justifiable, because it explicitly makes the ordering of the population sub-samples, using the poverty lines as cut-off points in a cumulative distribution of expenditure. Whenever poverty categories have a natural order, the ordered probit is the appropriate model to be employed in the estimation of relevant probabilities (Greene, 2002). Ordered response models recognize the indexed nature of various response variables. Underlying the indexing in such models is a latent but continuous descriptor of the response. In the ordered probit model, the random error associated with this continuous descriptor is assumed to follow a normal distribution.

The ordered probit model differs from a univariate probit one in that the dependent variable is no longer a dummy variable, but an ordered variable taking values 0, 1, 2, 3 according to the level of poverty the household is encountered with. As in a univariate probit model, the model is built around a latent regression variable. An ordered probit model allows for multiple ordered values for the dependent variable and analyzes the effect of each independent variable on the dependent variable. It measures the probability that this dependent variable (Yi , for the i-th household) falls in one of the discrete categories conditioned on levels of the independent variables(X_j). Suppose the level of poverty of the sample household i (Y_i*) is the unobserved variable (latent variable) and Y_i* is expressed in the following equation:

$$y_i^* = \beta_0 + \sum_{j=1}^{k} \beta_j x_{ji} + u_i \qquad (2)$$

where x_{ji} are the above mentioned explanatory variables; u_i are the residuals or error term and the β and μ_i are parameters to be estimated (Greene, 2002). We assume that u_i is normally distributed across observations. As mentioned previously, Y_i* is unobserved and we can only observe whether the household under consideration falls in category "0," "1," "2," or "3". So, what was observed is the following actual placement in the discrete category:

$Yi = 0$ if $Y_i^* < \mu_1$ (extremely poor[2])
$Yi = 1$ if $\mu_1 \leq Y_i^* < \mu_2$ (moderately poor)
$Yi = 2$ if $\mu_2 \leq Y_i^* < \mu_3$ (slightly non poor)
$Yi = 3$ if $\mu_3 \leq Y_i^*$ (non poor)

In this model, Y (the dependent variable) represents the intensity of poverty experienced by a household. Here intensity of poverty is defined according to the following four categories:

0 = extremely poor; PCAE[3] expenditure less than Br. 1102
1 = moderately poor; PCAE expenditure lies between Br. 1103 to 1468
2 = slightly non poor; PCAE expenditure between Br. 1469 to 1835
3 = non-poor; PCAE expenditure more than Br. 1835.

Coefficients of the ordered probit model (β) give an indication of positive or negative impact of an independent variable on the probability of being poor, but do not relay information concerning the magnitude of the effect. Using a transformation function, the model creates a linear index of the probabilities with a cumulative standard normal distribution. Given the classification, we can derive the probabilities of being poor of different degrees as follows:

$$\Pr(Y_i = 0) = \Pr(Y_i^* < \mu_1) = \Phi(\mu_1 - \beta' X_i)$$
$$\Pr(Y_i = 1) = \Pr(\mu_1 \leq Y_i^* < \mu_2) = \Phi(\mu_2 - \beta' X_i) - \Phi(\mu_1 - \beta' X_i)$$
$$\Pr(Y_i = 2) = \Pr(\mu_2 \leq Yi^* < \mu_3) = \Phi(\mu_3 - \beta' X_i) - \Phi(\mu_2 - \beta' X_i)$$
$$\Pr(Y_i = 3) = \Pr(\mu_3 \leq Y_i^*) = 1 - \Phi(\mu_3 - \beta' X_i)$$

where μ_i represent the threshold or cut-off parameters for placement of Y_i^* in the discrete poverty categories, and $\Phi(\ )$ is the standard normal cumulative distribution function such that the sum total of above probabilities is equal to one. We maximize the log-likelihood function to obtain the estimates of μ's and β's employing LIMDEP statistical software.

Marginal effects are calculated using the linear probability index. They tell us the effect on the probability of being poor in a particular category for changes in the independent variables ($\partial \Pr(Y=0, 1, 2, \text{and } 3)/ \partial Xi$). The marginal effect is the percentage change on the probability associated with a unit change in the explanatory variable. The marginal effect for each variable is calculated at the mean values of the independent variables. In this context, it

[2] extremely poor implies to households living in destitution and can manage to spend less than 75% of the poverty line; moderately poor refers to households living in poverty but can manage to spend from 75 – 100% of the poverty line; slightly non poor are households living on the margin with expenditure up to 25 greater than the poverty line; non poor households are those who are able to meet household expenditure comfortably and spend more than 25% in excess of the benchmark

[3] PCAE stands for per capita adult equivalent

is possible to assess the probability of being poor for given factors, and comparisons can then be made across characteristics.

Furthermore, since the underlying variable on which the severity of poverty is built is per capita consumption expenditure, the ordered probit analysis uses only an artificial construct as the endogenous variable. Much of the information about the actual relationship between consumption expenditure and determining factors might be lost, since a wide variance in consumption expenditure distribution is reduced to only few structures. Thus multivariate regression, perhaps allowing for structural differences for different parts of the distribution, may provide more information. Therefore a linear multivariate model using continuous expenditure data is presented to complement the ordered probit model.

4.2. Empirical results and discussion

The use of an ordered probit model enabled us to look at how particular variables affect the extent of household poverty. The results of the ordered probit estimation presented in Table 3 depict that the signs of most of the estimated parameters conform to our expectations with the exception of TLHPAE and TLU. But both were statistically insignificant (P>0.10). The likelihood ratio test for the goodness of fit shows a good fit for the model (P < 0.001).

In general, nine of the fifteen variables were found to be statistically significant in the ordered probit model at less than 10% probability level. Among the nine statistically significant explanatory variables, we found age of household head, non farm income, proportion of irrigated land owned, active participation in productive and social local level institutions and residence in Kersa and Kombolcha districts to be positively related to household well-being. Whereas size of household in adult equivalent and active membership of natural resource related local level institutions are covariates that are negatively correlated with the probability of being non-poor.

Given that the dependent variable of our regression, ORDPOV, is an ordered variable, we calculate the marginal effects of a unit change in a number of explanatory variables for the four categories of poverty which, to some extent, would reflect the effect of a unit change in any explanatory variable on the probability of a household of being extremely poor (ODRPOV = 0), moderately poor (ORDPOV = 1), slightly non poor (ORDPOV =2), and non poor (ORDPOV = 3). Table 4 shows the estimates of marginal effects of the variables, which allow further assessment of the estimate with respect to each poverty category. These marginal effect figures further strengthen the inferences obtained from the parameter estimates in the ordered probit model. In particular, we focus on the marginal effects which

are statistically significant in determining household poverty status, namely age of the household head, size of household in adult equivalent, non farm income, active membership in local level networks and organizations and the location.

<<Table 3 about here>>

Age (to a limit) is expected to be associated with skills enhancement (experience), accumulation of resources, extensive social capital and others that ought to contribute positively to well-being (Bashaasha et al., 2006). Our results seem also to confirm this statement. Age of household head is found to be positive and statistically significant ($p < 0.10$), implying that among the sample households older households have greater likelihood of being non poor. More specifically, an increase in age of household head by one year would increase the probability of being slightly non poor and non poor by 0.11 and 1.64 percent, respectively, where as it lowers the likelihood that a household will fall under category extremely poor and moderately poor by 0.66 and 1.09 percent respectively. Family size reflects the number of units among which household resources need to be allocated according to the weights of each unit. Family size may have an ambiguous role in poverty status of rural households depending on the relative strength of size economies in consumption as against the diminishing return to scale. In our sample, increase in household size by one adult equivalent would increase the probability of being extremely poor and moderately poor by 3.13 and 5.16 percent, respectively, where as it lowers the likelihood that a household will fall under category slightly non-poor and non-poor by 0.49 and 7.79 percent respectively.

Access to a non-farm source of income is also an important determinant of wellbeing in eastern Ethiopia. For a given level of other regressors, the probability of being slightly non-poor and non-poor increases by 0.01 and 0.01 respectively. Non-agricultural activities complement agricultural sources of income by availing the household additional resources for both consumption and investment. Investment in turn enhances asset accumulation and opens up additional escape routes out of poverty. Whereas much of non-agricultural sources of income have to do with education, opportunities exist to design strategies to stimulate low and semi-skilled types of non-farm employment opportunities in the rural areas as escape routes out of poverty. Access to irrigated land is essential for household welfare: The coefficient "proportion of land under irrigation" is statistically significant in determining the probability of being non-poor. The marginal effects indicate that a household with better access to irrigation is 40.43 percent more likely to be non-poor.

<<Table 4 about here>>

Results of the ordered probit model indicate that better off households are more likely to participate in social and religious (SRLLI) and governance and administration (GALLI) networks and organizations, where as the poorer are active with natural resource and production related networks and organizations (NPLLI). This result finds its explanation from the fact that natural resource related local level networks are largely supported by NGOs and also coordinated by the district bureau of agriculture so that rural households can participate in conservation practices such as building and maintaining terraces, planting trees and construction of feeder roads in return for food items through food for work programs. In this sense, participating in the latter offers immediate benefits in the form of food for poor households, but not necessarily social assets upon which further networks of social and economic benefits for the future could be built. This finding indicates that poor households are significantly underrepresented in governance networks as well as social networks. These networks are dominated by non-poor households.

Two district dummies for the three districts accounted for location-specific, district-level variations in the provision of public services, market opportunities and vulnerability to ecological uncertainties across the study districts. The probability of being non-poor was 21.40 percent for a rural household living in Kersa district, but only 17.55 per cent in Kombolcha district.

In order to scrutinize whether the ordered probit model has suffered from loss of information in the process of categorizing the dependent variable, we estimated an ordinary least square model (OLS) with continuous expenditure data as dependent variable whereas the explanatory variables remaining the same. The result indicates that (i) all the variables have the same sign except the dummy for Kombolcha district, (ii) only six explanatory variables turned out to be statistically significant with OLS estimate as compared to nine variables for ordered probit model and (iii) age dependency ratio turned out to be significant with OLS but not with ordered probit model.

5. Conclusions

This paper has studied extent of and the determinants of poverty in three districts in rural areas of eastern Ethiopia. The methodology used in this study confines to the analysis of relevant variables that make it more or less probable for a household to be poor. What we cannot assess through this methodology is the temporal aspect of welfare and vulnerability, i.e. the dynamics of poverty. However, a number of studies (Dercon et al 2005, Little et al

2006) have indicated the persistence of poverty in rural Ethiopia and our study complements these insights by looking into the factors that explain household poverty.

The study points out, among others, to three main reasons that explain the extent and variation in poverty levels across households studied: (1) poverty is location-specific as the stark variation between Babile and the other two districts has shown. This indicates how endowments with market access and relatively better agro-ecological conditions are essential factors in increasing household welfare, something where outside intervention can only partly help improve the situation. (2) Access to irrigated land (not land per se) and non-farm income are strongly correlated with lower probabilities of being poor. (3) Involvement in networks is a strong predictor of the probability of being poor – and we identified a clear differentiation in the types of networks that matter. Whereas poor households tend to participate in externally driven natural resource management networks, often induced through food for work incentives, the networks that really impact upon poverty levels are governance and social networks. It appears that active membership in the latter two is strongly correlated with a lower probability of being poor. This indicates that poor households face some kind of exclusion from those networks, possibly because others intentionally exclude them or because they cannot afford to participate and contribute to those networks.

This study also identifies spaces of entitlement failure that increase the probability of a household to be poor. These spaces encompass location (its agro-ecological endowments and its access to markets and non-farm income), social and governance networks (those networks where the poor are largely not a part of) and household composition. This conforms to findings of Bogale et al (2005), Sharp and Devereux (2004) and Bevan and Joireman (1997). The latter have argued that non-economic forms of assets, such as social assets and human assets are extremely important determinants in household welfare; Sharp and Devereux (2004) also mention (lack of) access to social network as important determinant of destitution. Not all of these entitlement failures can easily be addressed by external interventions. However, the exclusion of the poor from important governance networks could be politically mediated if the Ethiopian state and ruling regime were eagerly committed to doing so.

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Table 1. Poverty and inequality by district

District	Head count ratio FGT(0)	Poverty gap FGT(1)	Severity of poverty FGT(2)	Gini coefficient	
				Expenditure per adult equivalent	Income per adult equivalent
Babile	0.523	0.163	0.072	0.28	0.26
Kersa	0.175	0.029	0.009	0.18	0.23
Kombolcha	0.301	0.056	0.017	0.19	0.28
Overall sample	0.356	0.091	0.036	0.23	0.29

Table 2. Variable definition and their descriptive statistics

Variable	Description	Mean	Std. Dev.	Min.	Max.
Dependent Variable					
POVCAT	Four poverty categories: extremely poor (ODRPOV = 0); moderately poor (ORDPOV = 1); slightly non poor (ORDPOV =2) and non poor (ORDPOV = 3).				
Explanatory variables					
SEX	Dummy: 1 if the household head is male, 0 otherwise	0.875	0.331	0	1
AGE	Age of the household (years)	38.87	10.641	21	85
AGESQ	Age of the household squared	1623.6	1001.32	441	7225
HHAE	Number of household members in Adult equivalent (AE)	5.029	1.704	1	11.4
DEP	Age dependency ratio	1.478	0.896	0	4.0
EDUC	Year of schooling of the household head	1.185	1.213	0	4
TLHPAE	Land owned by the household per adult equivalent (ha)	0.206	0.131	0.03	0.91
TLU	Total livestock owned by the household in tropical livestock unit (TLU)	3.56	2.666	0	16.5
NONFARM	Total non farm income of the household	248.39	514.23	0	4800
IRRLANDP	Proportion of irrigated land owned	0.143	0.210	0	0.83
GALLI	Participation and active membership in governance and administrative institutions	0.514	0.501	0	1
SRLLI	Participation and active membership in social and religious institutions	0.815	0.389	0	1
NPLLI	Participation and active membership in natural resource and productive institutions	0.532	0.500	0	1
DW1	Dummy: 1 if the household lives in Babile district; 0 otherwise	0.398	0.491	0	1
DW2	Dummy: 1 if the household lives in Kersa district; 0 otherwise	0.264	0.442	0	1
DW3	Dummy: 1 if the household lives in Kombolcha district; 0 otherwise	0.338	0.474	0	1

Table 3. Ordered probit and OLS coefficients

Variables	Ordered probit			OLS estimation		
	Coeff.	Std. Err.	P-value	Coeff	Std. Err	P-value
Constant	2.128	1.125	0.079	2175.97	606.516	0.000
Sex of household head	0.1153	0.2530	0.649	95.5055	146.973	0.516
Age of the household (years)	0.0489	0.0264	0.064	8.36747	24.4632	0.732
Age of household head squared	-0.0005	0.0003	0.132	-0.11329	0.25844	0.661
Members of household (AE)	-0.2318	0.0630	0.000	-137.221	35.0491	0.000
Dependency ratio	-0.0242	0.1035	0.816	-157.887	55.9293	0.005
Schooling of household head (year)	-0.0053	0.0772	0.945	-32.1526	43.5229	0.460
Total land holding per AE	-0.0814	0.7754	0.916	-235.744	471.72	0.617
Livestock owned in TLU	-0.0288	0.0345	0.404	-10.8728	20.3131	0.593
Total non-farm income	0.0004	0.0002	0.052	0.11636	0.09834	0.238
Proportion of irrigated land	1.2032	0.5874	0.041	1111.12	260.04	0.000
Participation and membership in govern. & admin. Institutions	0.7119	0.1773	0.000	346.088	101.447	0.000
Participation and membership in social and religious institutions	1.0910	0.2351	0.000	317.111	134.508	0.019
Participation and membership in natural resource & prod. institutions	-0.5850	0.1750	0.001	-377.953	98.4187	0.000
Household lives in Kersa district	0.6369	0.2473	0.010	44.5793	150.042	0.766
Household lives in Kombolcha dist.	0.5222	0.2484	0.036	-46.8278	148.981	0.753
Mu(2)	1.0047	0.1536	0.000			
Mu(3)	2.0591	0.1962	0.000			
Log-likelihood		-219.26				
Restricted log-likelihood		-288.79				
Chi-squared		139.06				
R-squared					0.422	
Adjusted R Squared					0.378	

Note: Mu(0) is normalized to 0 by LIMDEP statistical software.

Table 4. Marginal effects of explanatory variables

Variables	ORDPOV=0	ORDPOV=1	ORDPOV=2	ORDPOV=3
Sex of household head	-0.0155	-0.0257	0.0025	0.0387
Age of the household (years)	-0.0066	-0.0109	0.0011	0.0164
Age of household head squared	0.0001	0.0001	0.0000	-0.0002
Members of household (AE)	0.0312	0.0516	-0.0049	-0.0779
Dependency ratio	0.0033	0.0054	-0.0005	-0.0082
Schooling of household head (year)	0.0007	0.0012	-0.0001	-0.0018
Total land holding per AE	0.0110	0.0181	-0.0017	-0.0274
Livestock owned in TLU	0.0039	0.0064	-0.0006	-0.0097
Total non-farm income	-0.0001	-0.0001	0.0001	0.0001
Proportion of irrigated land	-0.1622	-0.2679	0.0258	0.4043
Participation and membership in govern. & admin. Institutions	-0.096	-0.1585	0.0153	0.2392
Participation and membership in social and religious institutions	-0.1470	-0.2430	0.0234	0.3666
Participation and membership in natural resource & prod. institutions	0.0788	0.1303	-0.0125	-0.1966
Household lives in Kersa district	-0.0858	-0.1418	0.0136	0.2140
Household lives in Kombolcha dist.	-0.0704	-0.1163	0.0112	0.1755