MODELLING DETERMINANTS OF POVERTY IN ERITREA: A NEW APPROACH

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Abstract

This paper uses DOGEV model for modelling determinates of poverty in Eritrea by employing Eritrean Household Income and Expenditure Survey 1996/97 data. Education impacts welfare differently across poverty categories and there are pockets of poverty in the educated population sub group. Effect of household size is not the same across poverty categories. Contrary to the evidence in the literature the relationship between age and probability of being poor was found to be convex to the origin. Regional unemployment was found to be positively associated with poverty. Remittances, house ownership and access to sewage and sanitation facilities were found to be highly negatively related to poverty. This paper also finds out that there is captivity in poverty category and a significant correlation between poverty orderings which renders usage of standard multinomial/ordered logit in poverty analysis less defensible.

INTRODUCTION

Poverty is widespread in Eritrea. This has been one of the stylized facts of sub-Saharan Africa (Schoumaker, 2004). Regrettably, it has got the least attention and consequently there has not been a full-fledged poverty study in Eritrea to date. The income poverty measures presented in most cases are based on a Rapid Appraisal Survey conducted in 1993/94. Because the survey was conducted so soon after the war, when conditions were still unsettled, the results must be considered preliminary. About 50 percent of households in Eritrea were estimated to be poor in 1993–94, i.e., to not have sufficient income or endowments to consume a minimum requirement of 2000 calories per capita per day, plus a few other essential non food commodities such as clothing and housing. In that year because of drought, 70-80 percent of the households received food aid; without it, 69 percent of the population would have been unable to consume the minimum basket of food and other essential commodities (World bank, 1996).

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LITERATURE REVIEW

The art of modelling poverty seem to be preoccupied in getting the best criteria for the judgment of the poverty status of individuals. Rouband and Razafindrakoto(2003) assert that there is correlation of the objective and subjective poverty measures and further argue that the various forms of poverty are not reducible one against the other. Apart from being obsessed with monetary approach for measuring poverty there has been a growing literature which tries to come up with an index of multidimensional poverty facet[1]. However there is little conclusion so far and as Kanbur and Squire (1999) argue there is no material difference in the number of poor identified as poor by employing different approaches. This seems to be convincing for at least the hard core poor where they are poor are in every dimension. Moreover after comparing different definitions of poverty and their implication to poverty modelling Rouband and Razafindrakoto (2003) argue that the traditional approach of monetary approach to measurement of poverty seems justified as it is the one most correlated with the other subjective measures[2]. The devil is not on the usage of money metric unit for the determination of absolute poverty line rather on the mechanism employed for the derivation of such a line (Ravallion, 1996).The debate on the definition and measurement of poverty is really far from settled (see Ravallion, 1996 and Laderchi, R.C. *et al*, 2003[3]).

The unavailability of any poverty analysis in Eritrea and rigorous attempt to define and measure absolute poverty line constrains the choice to monetary approach developed by the World Bank. According to the World Bank quick appraisal group, absolute poverty line is "the minimum cash and non cash expenditure needed to be made by a person or household in order to be able to consume a minimum number of calories (food) plus a small number of essential non food items such as housing and

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[1] See Bourguignon and Chakravarty(2003) for the treatment of poverty measurement from multidimensional perspective.

[2] However, they assert that it is sufficient and would be good if it could be augmented by non monetary. Of course, ultimately any subjective approach will converge to the monetary approach, at least when it comes to practice. The capacity of the welfare ratio in representing the money metric unit of utility is a function of the institutional setting and the definition of welfare which is variant with time and spatial space.

[3] Ravallion (1996) comments on the modelling and measurement of poverty with reference to their repercussion to policy guidance. Laderchi, R.C. et al, 2003 give detailed discussion of the implication the different definitions of poverty to the measurement of poverty.

closing" (World bank, 1996:5). The World Bank group also calculate poverty lines with and with out food aid, original poverty line minus the amount of food aid received by a household[4]. Using this definition they calculate poverty lines by region and at national level. With out going deep into the philosophy of this argument we will adopt what was suggested by the World Bank.

There are basically two approaches in modelling determinants of poverty. The first approach[5] is the employment of consumption expenditure per adult equivalent and regress it against potential explanatory variables (Geda *et al*, 2001). Using this approach Arneberg and Pederson (2001) report that household characteristics and education are the main factors which affect living standard in Eritrea. However, they treat education as a linear and continuous variable. Moreover they find out that transfer payment from relatives abroad is a significant contributor to the welfare of a society. From their analysis they conclude that education is the most important factor for the way out of poverty. However, their approach suffers from the common problems of consumption as being indicator of welfare and the assumption that consumption of the poor and non poor are both determined by the same process (Okwi, 1999). The second approach is to directly model poverty by employing a discrete choice model.

The practice of discrete choice models in the analysis of determinants of poverty has been popular approach[6] (for instance, Fafack(2002) for Burkian'faso, Kabubuo-Mariara (2002) for Kenya; Amuedo_Dorantes(2004) for Chile; Grootaert(1997) for Cote D'voire; Geda *et al*(2001) for Kenya; Charlette-Gueard and Mesple-Somps (2001) for Cote d`voire , Goaed and Ghazouani(2001) for Tunisia; Roubaud and Razafindrakoto ,2003). The analysis then proceeds by employing binary logit or probit model to estimate the probability of a household being poor conditional up on

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[4] See World Bank (1996) for details of calculations. In addition the International poverty line one USD per day was employed but they fairly give almost the same classification which does not significantly change the multivariate analysis.

[5] This approach works by regressing consumption expenditure (in log terms) on the household, community and common characteristics which are supposed to determine household welfare, for example Glewwe(1990), Muller(1999) and Canagarajah and Portner(2003). This approach rests on a heroic assumption that higher expenditure implies higher utility and vice versa.

[6] Another approach is to combine these two approaches by using multinomial logit selection model to analyse the determinants of living standards (see Mckay and Coloube ,1996 for Muritania). This approach is not yet common though.

some characteristics. In some cases also the households are divided into three categories: absolute poor, poor and non poor and then employ ordered logit or ordered logit model to identify the factors which affect the probability a household being poor conditional up on set of characteristics. In this study we buy the latter approach to divide the population into poverty categories in Eritrea. However we employ DOGEV model a class of extreme value distributions which is proposed by Fry and Harris (2002).

The discrete choice model has a number of attractive features in comparison to the expenditure approach. The expenditure approach unlike the discrete choice models does not give probabilistic estimates for the classification of the sample into different poverty categories. In a sense we can not make probability statements about the effect of the variables in the poverty status of our economic agents. The consumption approach assumes that consumption expenditures are negatively correlated with absolute poverty at all expenditure levels. By the same logic, factors which increase expenditure reduce poverty. However, this is not always the case. For instance increasing consumption expenditure for individuals above the poverty line will not affect the poverty level. On the other hand in our discrete choice model we may allow the effects of independent variables to vary across poverty categories. Lastly our approach tries to capture any heterogeneity between the moderate poor, non poor and absolute poor with a possibility of weak test for of any captivity or "poverty trap" in static sense in each group. This is not possible in the expenditure function approach.

However this approach of modelling poverty is not with out flaws. The prime concern is that there is loss of information when we create categories of poverty status by the level of consumption expenditure or income. Secondly the fact that all those who are above the poverty line are intentionally considered to be homogenous or identical may not be tolerable (Jollife and Datt, 1999).This may imply superimposing censorship into the data set. Thirdly there is arbitrariness in the setting of the absolute poverty line. This necessitates the usage of some dominance analysis to check the robustness of the poverty line that we employ. Lastly we need to assume about the distribution of our non linear model. The last act is a matter of econometric practice, though.

Moreover there are two fundamental problems built in to the underlying assumption of employing standard ordered logit and Multinomial logit model which usually get little attention in such applications. With regards to former, the ordered logit/probit model, it is restrictive because it makes the parameters to be the same across groups. Ordered logit or ordered logit models necessitate the specification of a single latent variable in linear function. Consequently these models do not have the flexibility of MNL or multivariate probit (Small, 1987). Ravallion (1996) argues that although employment of binary response models as opposed to the multinomial logit model are redundant , it is not unjustified to attempt estimating set of regression functions by letting the impact of the explanatory variables to vary across the distribution poverty, poverty categories, as in multinomial logit model. This practice implicitly relaxes the first order dominance assumption implicit in the employment of a single parameter for each explanatory variable throughout the distribution of welfare ratio. With regards to the latter convenience is bought at the expense of heroic assumption, Independence of Irrelevant Alternatives (IIA), which does not stand in reality. IIA states that the

odds ratio $P_{ij}\big/P_{ik}$, $j \neq k$ is independent of the choice set. That is for any choice sets C_1 and C_2 such that $C_1 \subseteq C_n$ and $C_2 \subseteq C_n$, and for any alternatives i and j in both C_1 and C_2 we have

$$\frac{P(i/C_1)}{P(j/C_1)} = \frac{P(i/C_2)}{P(j/C_2)} \qquad\qquad 1$$

This assumption is in most instances implausible. Moreover Fry and Harris (1996) test for IIA and report that it has very poor power properties. There have been many suggestions in increasing the flexibility of the extreme value models so as to take into account of these fundamental problems (Koppelman and Sethi, 2000). The novelty of our methodology is that we employ alternative model which remedies these vital flaws. Unlike previous studies we employ a DOGEV model which allows for the parameters of explanatory variables to vary across poverty categories, as in the ordinary MNL and possible correlation between adjacent categories where the aim is mainly comparing the category specific error terms as in Diamond *et at*. (1990).

MODEL SPECIFICATION

Since at the heart of any poverty modelling exercise is identification of main factors which dictate poverty outcomes, we want to ask the following question: what is the probability that a family with particular identifiable characteristics will be found in a specific poverty stratum. This probabilistic framework for the study of poverty will assume that the real poverty status of the house holds is not observable or is not correctly indicated by the welfare ratio[7]. Following Fry and Harris (2002) we suggest DOGEV model [8] which nests the DOGIT and OGEV models as its variant.

The first feature of DOGEV, which is borrowed from Dogit, is the introduction of choice specific parameters rendering DOGEV to be flexible with additional parameters, θ_j and needs discussion so as to finesse the issue. Following Gaudry and Dagenais(1979) the Dogit discrete choice model takes the form:

$$P_{ij}^{DOGIT} = \frac{\exp(V_{ij}) + \theta_j \sum_{k=1}^{J} \exp(V_{ij})}{\left(1 + \sum_{k=1}^{J} \theta_k\right) \sum_{k=1}^{J} \exp(V_{ik})} \qquad \text{or}$$

$$P_{ij}^{DOGIT} = \frac{\theta_j}{\left(1 + \sum_{k=1}^{J} \theta_k\right)} + \frac{1}{1 + \sum_{k=1}^{J} \theta_k} \times P_{ij}^{MNL} \qquad\qquad 2$$

where P_{ij} is the probability of ith individual choosing alternative j.

θ_j is the parameter associated with j^{th} alternative; $\quad \theta_j \geq 0$

V_{ij} is the function of k independent attributes X_{ijk} of the jth alternative , i.e,

$V_{ij} = x_i' \beta_j$

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[7] One can also argue that these observed ratio of consumption to absolute level of poverty is less reliable and can only be trusted within a margin and hence the true poverty status of households is not correctly explained by these figures. Given the arbitrariness of poverty line also this division of poverty status into categories is not unreasonable.

[8] Although most of class of logit models are usually derived from a process of utility maximization, which is not observable behaviour, over discrete choices this approach abstains from a process of utility maximization perspective, although one can argue that there is an element of choice for being poor. For instance one can postulate that people will struggle to get out of poverty by going to school and may also choose the way of living and choice in which poverty strata to fall in. This is not to claim that people have readily available choices to fall under different poverty strata though. There may be a huge chunk of element which hinders individuals from choosing among potential alternatives. It is also fair to assume that any rational household will not choose to be in poverty. Although the decisions made by the family may lead to poverty and ultimately the household is choosing poverty. At best we can argue poverty is a manifestation of household choice. However in this paper the choice of multinomial probability distribution is purely pragmatic.

$$P_{ij}^{MNL} = \frac{\exp(V_{ij})}{\sum_{k=1}^{J} \exp(V_{ik})}$$

As it is clear from the above equation we can see that any two alternatives are not independent except in the special cases where all θ_j are equal to zero where in that case the model reduces to the ordinary MNL model. Given in this model that the probabilities of any two alternatives are affected by other alternatives is major behavioural departure from the Multinominal Logit model (Gaudry, 1980). This θ can be interpreted as a measure of captivity in the poverty category[9]. These θ_j can also be made to be a function of some observed heterogeneity (Fry and Harris, 2001). However in this paper we will not do that. Rather we will assume that these parameters will capture the heterogeneity across the different poverty status but constant across households[10].

These parameters can be interpreted as indication of heterogeneity of the outcome as opposed to individual heterogeneity. Moreover these parameters may indicate the individual heterogeneity which falls across each category. For example those who are in the absolute poverty category could not get out of that poverty because of physical disability which is not accounted by any of the explanatory variables in our model may be captured by θ_j. Generally this approach of modelling is very promising the fact that we have many war disabled veterans and elderly people who may be stuck in a poverty category. For instance as Deaton (1997) indicates malnutrition could impair productivity and thereby keep people in a poverty trap. Our model has a potential for capturing such imprisonment of household in a poverty jail because of some unobserved variables in the welfare categories.

The second advantage of DOGEV model is borrowed from OGEV- due to Small(1987). This model tries to mock-up a qualitative limited dependent variable with natural ordering and strong heterogeneity of the realized outcomes (Fry and Harris, 2002). It allows for a flexible covariance pattern between alternatives as

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[9] In the analysis of demand this is interpreted as the income effects and its role is reducing the own price elasticity of logit estimates and increases the cross partial elasticity (Gaudry, 1980).
[10] see Fry et al(2002) for parameterized DOGEV model . Borderly(1990) argues that the Dogit model is useful with out perfect captivity.

opposed to the IIA of MNL model. This paper contends that there may be correlation among the unobserved traits of several alternatives facing a given sample member in the poverty categories. In the terminology of Small (1987), we introduce stochastic correlation between choices of close proximity. This correlation is a variant of the moving average which fades out with distance between the alternatives, say j and k and in addition we assume following Small (1987) that it will be zero if $[j - k] > 2$. The standard OGEV probabilities are given by

$$
P_{ij}^{OGEV} = \frac{\exp(\rho^{-1}V_{ij})}{\sum_{r=1}^{J+1}\left(\exp\left(\rho^{-1}V_{ir-1}\right)+\exp\left(\rho^{-1}V_{ir}\right)\right)^{\rho}} \times \left[\left(\exp\left(\rho^{-1}V_{ij-1}\right)+\exp\left(\rho^{-1}V_{ij}\right)\right)^{\rho-1}\right]
$$
$$
+ \left(\exp\left(\rho^{-1}V_{ij}\right)+\exp\left(\rho^{-1}V_{ij+1}\right)\right)^{\rho-1}
$$

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With the convention that $\exp\left(\rho^{-1}V_{i0}\right)= \exp\left(\rho^{-1}V_{iJ+1}\right)= 0$ and $0 < \rho < 1$.

The correlation parameter ρ is an inverse measure of the correlation between the neighbouring outcomes. It does not have closed formula in this specification though. In the limit as ρ approaches to 1, the above OGEV model collapses to an ordinary MNL model. Thus we can set $\rho = 1$ as a hypothesis to test OGEV versus MNL. That is to say we are implicitly checking if there is ordering in our choice set[11].

Following DOGEV model proposed by Fry and Harris (2002), the paper argues that poverty status ordering is based on an underling distribution of welfare ratio. In addition the dependent variable, the poverty ordering is the representation of the underlying continuous variable of poverty. The fact that we employ poverty line to create a jump or discontinuity in the poverty status of households, we may expect high probability of correlation between poverty outcomes[12]. The DOGEV discrete choice model takes the form:

$$
P_{ij}^{DOGEV} = \frac{\theta_j}{1+\sum_{k=1}^{M}\theta_k} + \frac{1}{1+\sum_{k=1}^{M}\theta_k} \times P_{ij}^{OGEV}
$$

4

where we have the nested models

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[11] Small (1987) shows that as $\rho = 0$ the cumulative distribution function collapses to one and he argues that it is still in line with the random utility maximization.

[12] Employment of absolute poverty line implies that there is a discontinuity in the distribution of welfare (Deaton, 1997).

OGEV: $\theta_1 = ... = \theta_M = 0, 0 < \rho \le 1$

DOGIT: $\rho = 1$ at least one $\theta_j > 0, j = 1,..., J$

MNL: $\theta_1 = ... = \theta_M = 0, \rho = 1$

The latter two do not incorporate any ordering between outcomes. However the former does. The capability of modelling an ordinal data in such a way that it captures any captivity makes DOGEV more attractive. The above nested models can be tested by the classical testing mechanisms but now with one sided test.

As in the usual binary mode we are not interested in β. We are interested in the marginal effects of changes in the regressors. However because of the complications in the computation of these marginal effects we will report the change in the probabilities as a result of change in the variables of interest throughout this paper, which are essentially marginal effects in any case.

To estimate the DOGEV model we employ maximum likelihood technique. By employing an indicator function $h_{ij} = 1$ if an individual i chooses alternative j or 0 otherwise. The log-likelihood function is given by

$$L(\phi) = \sum_{j=1}^{J} \sum_{i=1}^{N} h_{ij} \ln P_{ij}^{DOGEV} \quad \text{where} \quad \phi' = \left[\left(vec\beta_j \right), \theta', \rho \right] \quad \text{and} \quad P_{ij}^{DOGEV} \quad \text{given by equation}$$

4. Likewise the log likelihood functions for the nested models could be written down simply by imposing restrictions to this general log likelihood function.

DATA

The data are drawn from the Eritrean Household Income and Expenditure Survey (EHIES), an urban survey that was conducted in the large towns of Eritrea in 1996. The survey was conducted from July to September 1996 in four rounds so as to incorporate seasonal variations in data collection It was designed to be able to report separately from five main geographical reporting domains corresponding to the three large towns, the Highlands and the Western Lowlands. The National Statistics Office selected a sample size of 5,061 households. Of the selected total 5,061 households, the surveyors were able to include 4,644 households in the data. The non-response rate was very low. However, the data do not include all the variables needed for the

analysis, and the data set also has many missing observations and some outliers. These problems are omnipresent in most developing countries (Deaton, 1997). As a result, the data had to be cleaned for the missing information and anomalies and the effective sample size was 3712 households. The absence of any operational sampling framework in the country necessitated complete mapping and listing of all households in all towns except in one town, Keren. The sampling method employed was one-stage stratified sampling in all towns. Simple random sampling was used to choose households from the selected clusters.

DESCRIPTIVE ANALYSIS

In this section we give descriptive analysis of the data used for analysis. We first define our dependent variable with the dependent variable in our analysis. The welfare ratio (y_i) was derived by dividing expenditure per capita adjusted for household size by respective regional poverty line. In the second stage each household is assigned to poverty categories as per the following: absolute poverty if $y_i < 0.75$; moderate *poverty: if* $0.75 < y_i \leq 1.25$ and non poor if $y_i > 1.25$.

Table 1.Distribution of poverty by welfare index

|	Poverty category			Total
	Non poor	Moderate Poor	Absolute poor	
Frequency	1,108	1,433	1,171	3,712
Percentage	29.85	38.6	31.55	100

Source: Authors calculation from EHIES 1996/97.
Note: As a robustness check we also employed the International poverty line suggested by World Bank but they give similar classification; with 31 35 and 34 percent being in absolute poverty, moderate poverty and non poor category.

Table 1 above clearly shows that 68.5 % of our sample dwells in poverty with 30 percent in absolute poverty and 38.5 percent in moderate poverty. Eventhough strictly speaking this is not a measure of poverty index it is very close to the World Bank's head count index which is reported to be about 69 percent (World bank, 1996).

Poverty is not evenly distributed across different regions of Eritrea. At regional level there are various characteristics that might correlate with poverty. The relationship of these factors to poverty is of course a function of space and time. However generally there a convention among development economists those areas with low resource

base and isolated from the main markets because of infrastructure and other facilities are supposed to be more poverty socked than the urban areas in the core or around
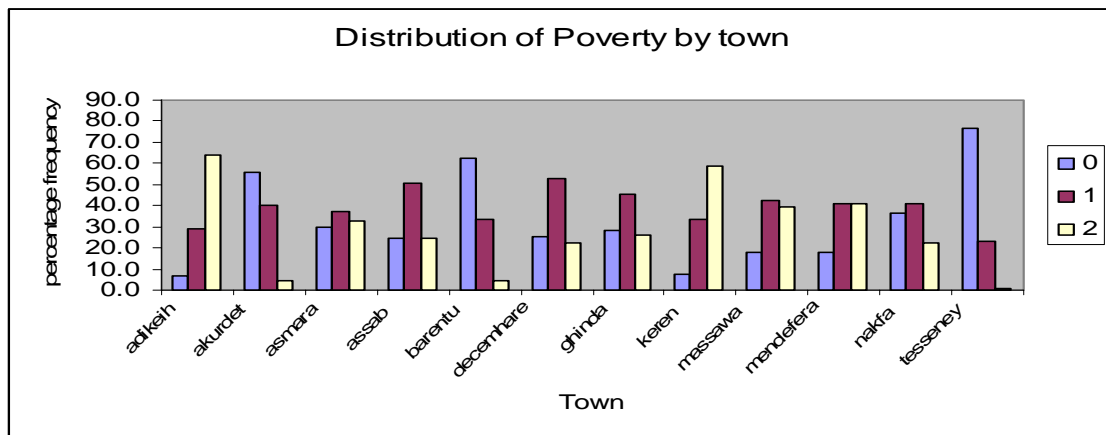
Source: Authors calculation from EHIES 1996/97.
Note: 0= Non poor. 1= Moderate poor. 2=Absolute poor.

Figure 1

harbour. There is remarkable difference in terms of weather, level of development and population distribution among urban areas. Figure 1 above clearly shows that majority of the extreme poor are found in Adikeih, Keren and Nakfa. This may be explained by the regional unemployment rate being the highest in Adikeih, 20% followed by Keren 18 %. Moreover the disparities may be explained by the inadequate public services and weak communications and infrastructures as well as underdeveloped markets in these periphery towns.
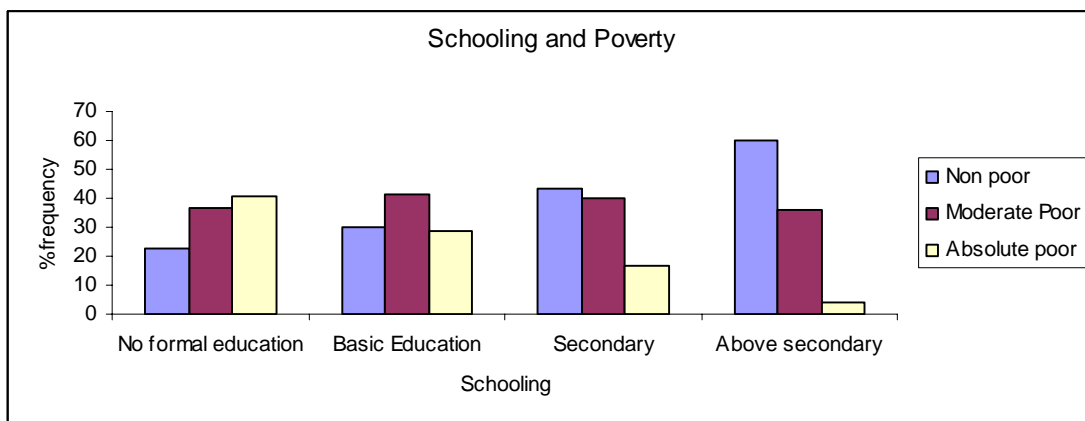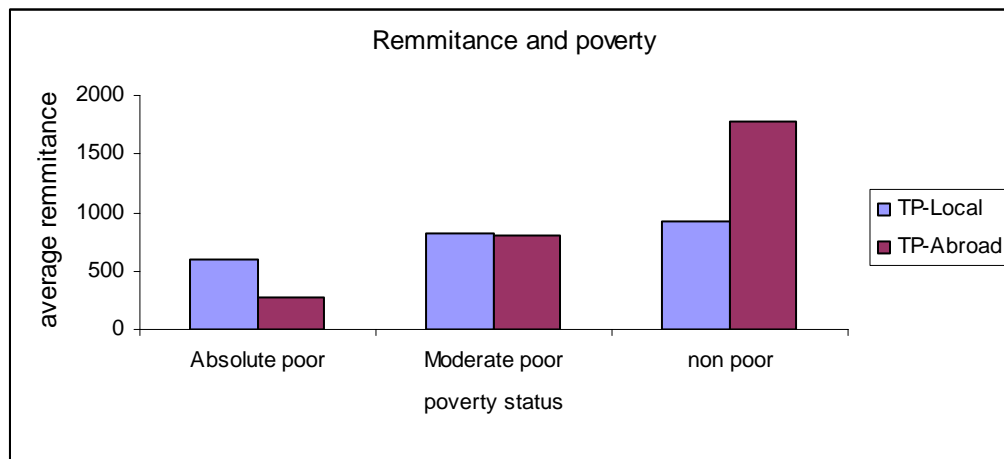

Source: Authors calculation from EHIES 1996/97
Note: Basic education= grade 1-7. Secondary =grade 8-12. Above secondary= Grade >=12

Figure 2

Development thinkers and economists has long been busy postulating a positive association between schooling and economic wellbeing. Figure 2 summarizes the

distribution of poverty across different educational attainments of household head. Figure 2 shows that there is negative association between poverty and schooling. Specifically 77% of the households with no formal education dwell in poverty among which 41 percent being in the absolute poverty. While the distribution of absolute poverty decreases with an increase in education level, the number of non poor increases with increases in years of schooling completed. As far as the distribution of moderate poor is concerned figure 2 suggests that it marginally increases until elementary school and thereafter decreases slightly with increases in levels of schooling completed. In light of these this paper employs dummy variables for the different levels of education I the multivariate analysis.

Remittances from relatives within Eritrea or abroad are good indicators of poverty in Eritrea Arneberg and Pederson (2001). However remittance is not evenly distributed. Distribution of remittances mainly from relatives in Diaspora is inversely related to poverty. Figure 3 shows that both remittances from relatives with in Eritrea and from abroad are higher for the non poor households than poor household. In addition the moderate poor household gets a slightly higher amount of remittance than the absolute poor.[13]
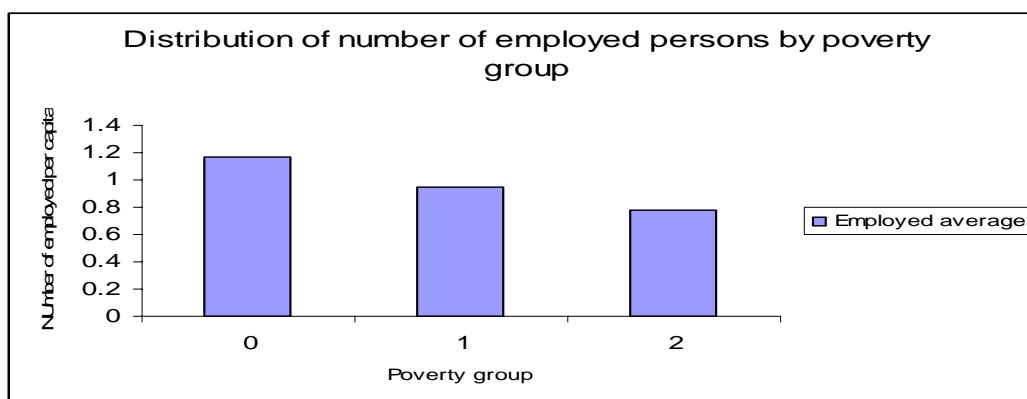

Source: Authors calculation from EHIES 1996/97.

Figure 3

The number of employed persons per household is a good gauge of poverty. It is expected to be positively associated with poverty. The reasoning is straight forward, more persons working implies more income coming to the household and

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[13] It is estimated that about one third of the population of Eritrea is in Diaspora.

Distribution of number of employed persons by poverty group

Source: Authors calculation from EHIES 1996/97.

Figure 4

hence improvement in welfare. Figure 4 conforms to a priori expectation. On the average the non poor people have higher number of people employed than both moderate poor and absolute poor category. It is to be noted also that the number of employed persons in moderately poor household is higher than those in the absolute poverty.

In summary the above preliminary investigation suggests the significance of demographic variables, human capital indicators, number of employment present, regional unemployment, locality of residence and the availability of remittance from abroad and home as determinants of poverty in Eritrea. However as it turn out to be the above univariate analysis may not uncover some of the underlying relationships which need to be seen in isolation. The next section presents multivariate analysis of the above relationships by controlling some other underlying observed and unobserved characterises. The model to be employed was developed in the previous section.

EMPIRICAL RESULTS

This section presents the estimated DOGEV model. Model discussed in the previous section was estimated using poverty index as a dependent variable and explanatory variables: demographic variables, community variables, labour force variables, remittance, schooling, access to social services by controlling for regional differences.

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The preferred model is DOGEV but we also report the results of ordered logit for comparison purpose. Table 2 and 3 report DOGEV and ordered logit models.

Before presenting discussion of the coefficients it is worth discoursing the captivity parameters and correlation between neighbouring outcomes, on which the ultimate legitimacy of employing GODEV lies. With regards to the latter, as was explained in the model development section, following Small (1978) the relevant test for the ordering is a null of $\rho = 1$. According to table 2 the computed test statistic is big enough to allow us reject the null hypothesis in favour of the alternative at less than 1% level. With regards to the former table 4 indicates that θ_1 and θ_2 are significantly different from zero at 1% level of significance. However the captivity parameter for the first category θ_0 was not significantly different from zero as per our expectation, because we would not expect any captivity in the non poor category. Our model was estimated by imposing such an a priori restriction.

As far as the size of the captivity parameters is concerned it can be seen from their contribution towards the total probability of observing a certain household being in a poverty category, $\dfrac{\theta_j}{1 + \sum_{k=1}^{M} \theta_k}$. In most instances the contribution of the captivity element towards the total predicted probabilities are of significant in size. It was found out that the contribution of θ_1 and θ_2 towards the total predicted probabilities on the average were 11 and 6 percent respectively. It is to be noted that the captivity parameters are constant across individuals and hence their contribution towards each individual variable can simply be found by dividing to the total probabilities associated with each outcome at given values of the selected variables. The larger the total probabilities as the explanatory variable change the smaller the contribution of the captivity elements and vis-versa (see Table 3 in Appendix).

The captivity parameters may be explained by what characterizes deprivation, vulnerability (high risk and low capacity to cope), and powerlessness (Lipton and Ravallion, 1995; Sen, 1999). These characteristics weaken people's sense of well-being. Poverty can be chronic or transient, but transient poverty, if acute, can trap succeeding generations. According to our results the fact that the captivity element for

Table 2 DOGEV model: dependent variable poverty

Variables	Moderate Poor Coefficient	Moderate Poor Standard Error	Absolute poor Coefficient	Absolute poor Standard Error
CONSTANT	-3.182	0.603*	-7.698	1.179*
Demographic variables				
Age of head of household	0.165	0.162	-0.006	0.167
Square age of head of household	-0.252	0.163	-0.086	0.169
Household size	0.309	0.054*	0.473	0.069*
Married	-0.301	0.112*	-0.816	0.154*
Widowed	-0.156	0.152	-0.369	0.188**
Community variables				
Christian	-0.224	0.144	-0.264	0.196
Tigrigna	-0.685	0.158*	-1.205	0.224*
Returnees from the Sudan	0.397	0.187**	0.182	0.261
Fighter	-0.190	0.126	-0.541	0.181*
Labour Force variables				
Number of children below age of 5	-0.221	0.073*	-0.291	0.094*
Number of children between age 5-15	-0.164	0.063*	-0.162	0.079**
Number of employed per household	-0.715	0.093*	-1.342	0.146*
Regional Unemployment rate	0.302	0.036*	0.679	0.082*
Employee in private sector	0.373	0.151*	0.691	0.192*
Government employee	0.107	0.125	0.272	0.169
Self employed	-0.025	0.109	-0.123	0.145
Remittance				
Transfer from relatives in Eritrea	-0.156	0.029*	-0.459	0.059*
Transfer from relatives in Diaspora	-0.226	0.029*	-0.736	0.078*
Schooling				
No formal schooling	0.793	0.252*	1.563	0.366*
Grade 1-7	0.298	0.236	0.475	0.338
Grade 8-12	-0.429	0.245***	-0.675	0.356***
Above 12 grade	-1.056	0.292*	-2.597	0.533*
Access of Services				
House	-0.489	0.105*	-0.790	0.135*
Sewage	-0.557	0.167*	-1.103	0.237*
Region				
Adikeih	-0.542	0.403	-1.362	0.517*
Akurdet	0.591	0.194*	0.736	0.557
Asmara	1.139	0.167*	2.936	0.375*
Assab	0.811	0.201*	1.354	0.291*
Barentu	-2.452	0.313*	-5.708	0.658*
Decemhare	0.670	0.229*	0.888	0.304*
Ghinda	-1.982	0.297*	-4.180	0.485*
Keren	-0.229	0.270	-0.862	0.344*
Massawa	2.499	0.289*	5.448	0.667*
Captivity Variables				
θ_1	0.071	0.027*		
θ_2	0.010	0.005**		
RHO	0.486	0.167*		
Log likelihood				
N	3712			

Source: Authors calculation from EHIES 1996/97.

*significant at 1% **significant at 5% ***significant at 10%

Table 3 Ordered logit model, dependent variable poverty

	Coefficient	Standard Errors
Demographic variables		
Age of head of household	0.0073	0.0139
Square age of head of household	-0.0001	0.0001
Household size	0.2643	0.0397*
Married	-0.5617	0.0973*
Widowed	-0.2628	0.1267*
Community variables		
Christian	0.2242	0.1345**
Tigrigna	-0.8316	0.1394*
Returnees from Sudan	-0.1962	0.1181**
Fighter	-0.3275	0.1143*
Labour Force variables		
Number of children below age of 5	-0.1371	0.0593*
Number of children between age 5-15	-0.0725	0.0525
Number of employed per household	-0.8164	0.0731*
Regional Unemployment rate	0.4192	0.0250*
Employee in private sector	0.4288	0.1209*
Government employee	-0.1579	0.1403
Self employed	-0.1163	0.1000
Remittance		
Transfer from relatives in Eritrea	-0.0003	0.00003*
Transfer from relatives in Diaspora	-0.0003	0.00004*
Schooling		
No formal schooling	1.0974	0.2366*
Grade 1-7	0.3619	0.2316
Grade8-12	-0.4728	0.2450**
Above 12 grade	-1.5641	0.2728*
Access of Services		
House	-0.5309	0.0803*
Sewage	-0.7410	0.1544*
Region		
Adikeih	-0.8083	0.2680*
Akurdet	0.4055	0.1846*
Asmara	1.8044	0.1438*
Assab	0.8756	0.1646*
Barentu	-3.6759	0.2283*
Decemhare	0.5035	0.1806*
Ghinda	-2.7332	0.2389*
Keren	-0.5191	0.1948*
Massawa	3.4016	0.1911*
Ancillary parameters		
_cut1	3.5657	0.4857*
_cut2	6.1580	0.4951*
N	3712	
Wald(3) Chi2		
Pseu-dolikelihood		
Predicted prob(Poverty=0)	0.219	
Predicted prob(Poverty=1)	0.520	
Predicted prob(Poverty=2)	0.261	

Source: Authors calculation from EHIES 1996/97. Significant at 1% level of significance.
** Significant at 5% level of significance. *** Significant at 10% level of significance

the absolute poor is significant may suggest that there is a possibility for the poor being rigid in that poverty. Even though panel data analysis would be a better approach to capture the phenomenon of poverty trap, this would be an indication such a trap which may accumulate through time. Besides the captivity elements could be explained by demand factors such as occupational choice , capacity of households in expanding their horizon, attitude towards life, learned helplessness, lack of social network for job hunting, credit constraint and others make households to be rigid in poverty. It is also justice to contend that it is not always implausible to assume that some people may get used to the way of life in poverty and may not do any industrious effort to change their life[14].

Table 4 Hit and Miss Table

Predicted				
	Non poor	Moderate Poverty	Absolute Poverty	Total
Actual				
Non poor	741	311	56	1108
Moderate Poverty	297	778	358	1433
Absolute Poverty	40	299	832	1171
Total	1078	1388	1246	3712
Sample proportions and predicted probabilities				
	Captivity element	total probabilities	sample proportions	
Non poor	-	0.232297	0.2985	
Moderate Poverty	0.065574	0.497148	0.386	
Absolute Poverty	0.009417	0.270555	0.3155	

Source: Authors calculation from EHIES 1996/97.

Before discussing the coefficients it may be worth to discuss the predictive capacity of our model. One of a helpful summary of the predictive power of our model is hit and miss table. Table 4 summarizes the predicted and actual number of households across different poverty categories. The hit and miss table shows the percentage of correctly predicted observations for non poor , moderate poor and absolute poor category households are , 67 %, 54.3% and 71% respectively. We also report sample proportions and the average predicted probabilities for each category. The model has good fit when we see the sample proportions and predicted probabilities except we find that the moderate poor category is over predicted. But this over prediction of

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[14] This is of course a transgression from the basic tenets of economics where individuals are assumed to be rational and higher income or consumption is equated with higher welfare. Indeed it seems more reasonable to assume people are near rational rather than perfectly rational.

dominant outcome is common phenomenon in discrete choice models (Duncan and Harris, 2002).

The effects of household size on household welfare depend in part on the degree of rivalry in consumption among household members (Lanjouw and Ravallion 1995). One extreme case is that all consumption is public so that every marginal increase in consumption benefits all household members. Examples of such consumption could be increased security or the provision of a tap providing clean drinking water. The other extreme case is that all consumption is private which implies that only one person can benefit from any one consumption activity. Nutrition is almost completely private, except perhaps for pregnant and breastfeeding mothers and to the extent that one person enjoys another being well fed (parents for example may be altruistic towards their children). In addition, there may be synergies from larger household size, both in production and in consumption. Working in groups can be more productive through improved supervision, pooling of tools and experience, or higher motivation. Food preparation meanwhile can be less wasteful for larger groups. For a given degree of rivalry in production and consumption, returns to scale can thus have an impact on household welfare via household size. Considering the additional problems involved in estimating the rivalry and the scale effects of consumption, this analysis does not try to differentiate between the different effects of household composition on poverty. Instead, household size variables (household size, number of children in a household and number of employed in the household) will be included both for their role in determining household welfare and to account for differences between households in their composition as in Deaton and Zaidi (1999) and Glewwe (1991).

Household size defined by adult equivalent units has significant negative effect on the welfare status of a household. This is a general finding in the poverty literature (see for instance Lipton and Ravallion 1995, Lanjouw and Ravallion 1995). The size of the effect of household size on poverty is not the same across the categories though. The effect is most pronounced in the absolute poverty category. Figure 5 reports the predicted probabilities of being in different poverty categories at different household sizes keeping all other variables at their mean values. The probability of being in non

poor category decreases sharply for the first four members and thereafter it decreases at a decreasing rate may be due to economies of scale, throughout and reaches level zero after household size reaches 10. As far as the relationship between probabilities of being in moderate poverty concerned it is flat inverted U. Predicted probabilities tend to increases until household size of 5 and thereafter starts decreasing slowly. This decrease in the probability of moderate poor does not tell us an improvement in the household welfare rather it is translated to an absolute poverty which matches with an increase in probability of being absolute poor at an increasing rate and sharp decline of probability of being non poor.
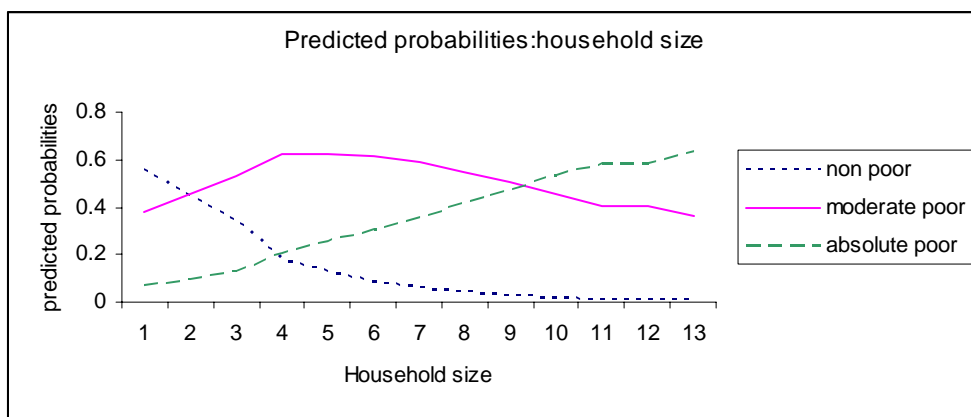
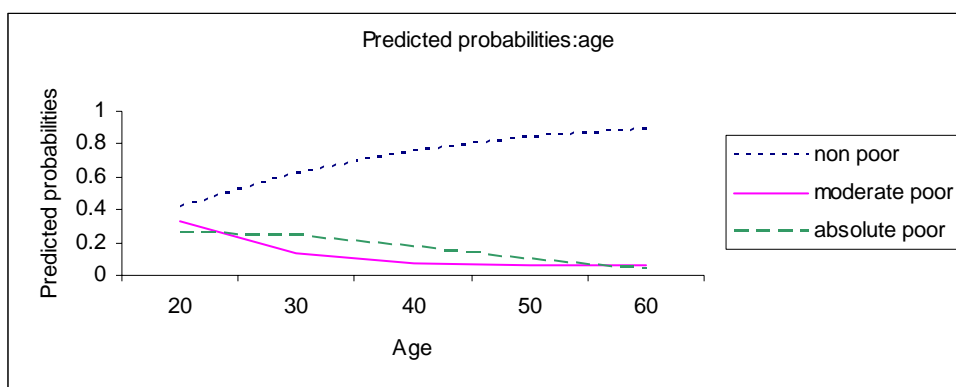Source: Authors calculation from EHIES 1996/97.

Figure 5

Surprisingly, the coefficients of number of children below the age of 5 and below the age of 15 was found to be negative and significant in all poverty status, keeping all the other things constant. This paradoxical result may be partially interpreted as indicator of presence of economies of scale in the household but would be very implausible to completely attribute to economies of scale[15]. This anomaly may be credited mainly to data problems (Deaton, 1997). Andeberg and Pederson (2001) do not include these variables in their attempt to model living standards using the same data perhaps due to the problematic nature of these variables.

Age of household head was not found to be significant in linear terms in both models. There have been similar finding by other authors though using a different techniques

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[15] Dependency ratio was calculated instead of these two variables but still the coefficient was found to be negative and significant. Different specifications were also employed but still the relationship remains the same with slight change in the size of coefficient.

(Andeberg and Pederson, 2001 for Eritrea, Charlette Guenard and Mesple'-Somps for Cote Divoire and Goiled and Ghazouani, 2001 for Tunisia). This is not in agreement with the literature where higher age is correlated with higher productivity and hence impacts welfare positively. However the coefficient of age squared in our DOGEV model was found to be negative and significant at 10 percent level of significance in the moderate poor category only. Moreover age and age squared are jointly statistically significant. Hence we see that the DOGEV model is superior over the ordinary logit which assigns same parameter to the three categories. This negative quadratic term may be explained by an increase in probability of getting some help from grown up children during old age. As it was discussed in the previous section remittance from family at home and Diaspora is highly negatively correlated with poverty in Eritrea. This is really in clear contrast to the evidence in the literature where the relationship between poverty and age is assumed to be "U" shaped (Barrientos *et al*, 2003). Of course this premise of "U" relationship is merely based on productivity argument and does not take into account the fact that children are assets in most developing countries and can really change the poverty profile of a house hold[16]. Our predicted probability graphs in Figure 6 show that the relationship is convex to the origin, indicating that the probability of being poor decreases with an increase in age keeping all other things constant. If we turn to the probabilities of being non poor the story is reversed and the relationship becomes concave.

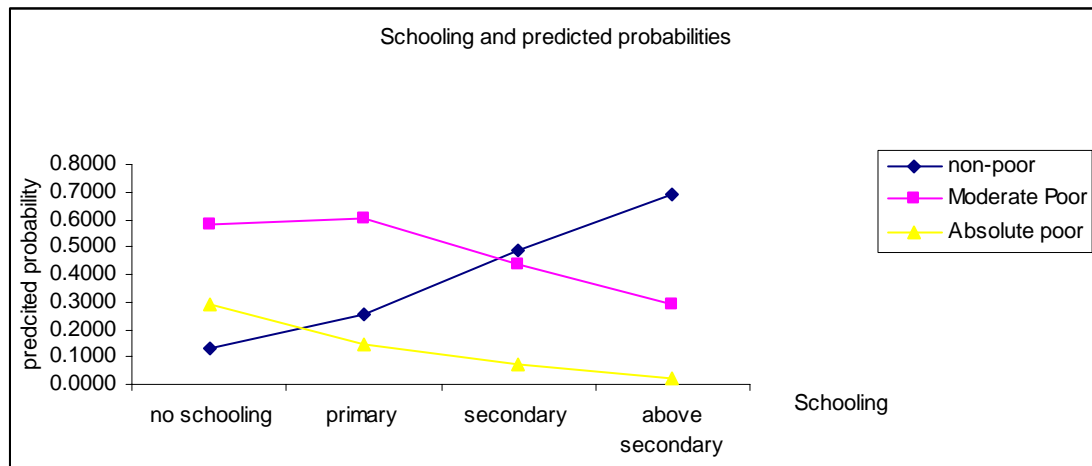Source: Authors calculation from EHIES 1996/97.

Figure 6

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[16] Its not plausible to assume that poor children always grow to poor adults. It is possible that a talented child could be born from poor family and making use of his talent could salvage the family. Of course this is not to deny that poverty could make potentially able individual to dwell in destitution by creating financial and other constraints.

The effect of years of schooling on poverty is found to be non uniform across the different poverty outcomes and levels of schooling completed by head of household. The coefficient for no schooling is negative and significant at less than 1% level in our model across the different poverty categories. This suggests that the probability of being poor relative to non poor increases if one does not have formal education, keeping all other things the same. This may be explained by human capital theory where education is assumed to increase productivity and thereby earnings. This is self intuitive at least for the skilled jobs where formal education is required. The coefficient of primary education is not significant in our models throughout all outcomes. With regards to junior high school and above high school education the coefficients are found to be negative and significant at 10 % and 1% level of significance, respectively.

The coefficients of the schooling dummies are not the same for three outcomes, though. This may suggest that education impacts welfare differently in the three outcomes. For instance the coefficient of schooling is higher (absolute terms) in the absolute poor category than in the other categories. Figure 7 presents the predicted probabilities associated with different levels of schooling. It is clear from Figure 7 as the level of schooling increases the probability of being in the absolute poverty category decreases sharply and reaches to the level of zero after high school complete, *ceteris paribus*. When we look the probability of being in moderate poor the figure shows that the probability of being in moderate poor falls sharply after primary school. Moreover, it merits mention that the percentage contribution of captivity elements towards total probability of being absolute poor and moderate given a household head has above high school education are very large , 47.5% and 22.5% ,respectively. This may be explained by demand side factors such occupation category where for instance a college graduate works in low paying non professional occupation. Figure 7 also hints interesting results implying that education is not sufficient condition to escape from poverty as the probability of being in moderate poverty never reaches zero with an increase in years of schooling. It is not awkward to envisage that there are other factors which affect the plight of a household in conjunction with education. There is a need for complementary factors to be provided along side with education so as to alleviate poverty. By employing consumption

function approach Arneberg and Pederson (2001) identify education as a key factor for getting out of poverty cell in Eritrea. However they assume uniform and linear impact of education on welfare. Our finding reinforces their recommendation but it clearly postulates that basic education will not suffice.
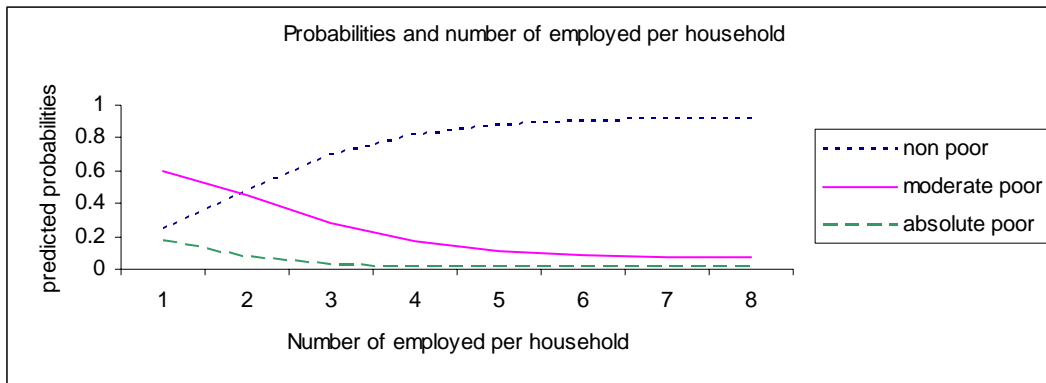

Source: Authors calculation from EHIES 1996/97.

Figure 7

The coefficients of transfer payments from relatives with in Eritrea and outside Eritrea are found to be negative and significant at 1 % level of significance. In Eritrea having relatives who can send money in Diaspora is a blessing. About half of the source of income for the well off families is non labour income in the form of transfer payment (Arneberg and Pederson ,2001). This is not surprising given strong family ties with in Eritrean society. This is interesting result the fact that Eritrea does not have social security system it may help to pursue policies which foster cultural ties and family networks as part of poverty alleviating endeavour. This may also have implications for immigration policies. Eventhough there are other socio-political considerations besides to the economic reason such as defence and other reasons the relaxation of immigration laws or motivation of individuals to migrate abroad is suggested by the above results to assuage poverty[17]. Adams and Page (2003) argue that at macro level remittance can help to reduce poverty. However it must be remembered that remittance is not evenly distributed throughout the society. Because international migration involves substantial travel costs most migrants are from the non poor families.

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[17]This partially vindicates the massive immigration of Eritreans aborad. Eritreans need an exit visa to leave their country.

The coefficient of the number of employed persons in a household was found to be negative and significant at less than 1% level. In addition the marginal effect shows that it has the largest marginal effect on the probability of being poor, keeping all other things constant. This is in line with conversional wisdom in labour economics. Figure 8 plots the predicted probabilities of being in different poverty status and number of employed persons in a household. It is evident from the graph that the probability of being in absolute poverty and moderate poverty sharply decreases with

Probabilities and number of employed per household

Source: Authors calculation from EHIES 1996/97.

Figure 8

an increase in number of employed persons, keeping all other things constant. Figure 8 vividly depicts also that graph of probability of a household being non poor and number of employed persons per household is concave. The probability of being non poor increases at an increasing rate for the first three employed persons and thereafter starters to increase at a decreasing rate, keeping all other things constant. These results suggest that labour market policies could be potentially effective for tackling poverty in Eritrea. However caution is needed before adopting such a policy prescription. We need to ascertain if the people considered to be poor are employable indeed. It is possible that because of the war situation and aging population most of those who are poor and unemployed may turn out to be non employable.

Among the employment sector dummies only the coefficient of private sector employment was found to be positive and significant at 1% level of significance. Figure 9 reports that the probability of being poor is about 8% higher than non private sector employee, keeping all other things same. The probability of a private sector employee being non poor is about 9 percent lower than non private sector employee,
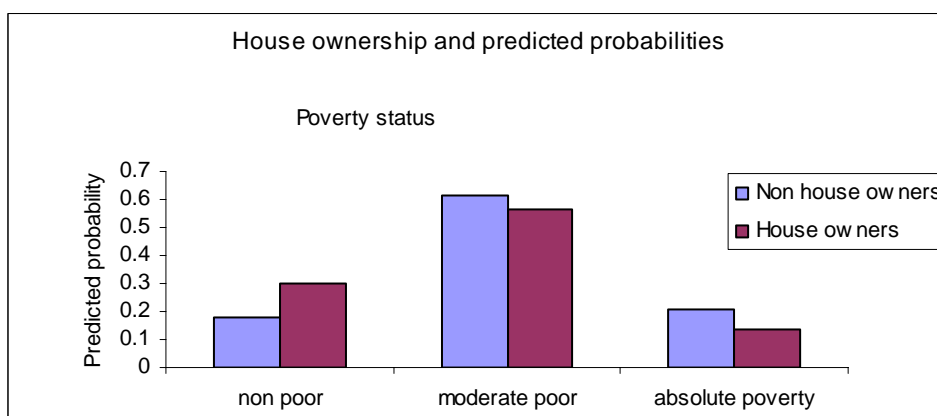
whereas the probability of being moderate poor remains almost unaltered, keeping all other things constant. This may be partially explained by the expulsion of Non Governmental Organizations from Eritrea which may have rendered many people unemployed and join the poverty club. It may also reflect the presence of low paying unskilled job categories such as housemaid and other low paying jobs which may drag people into poverty confinement.
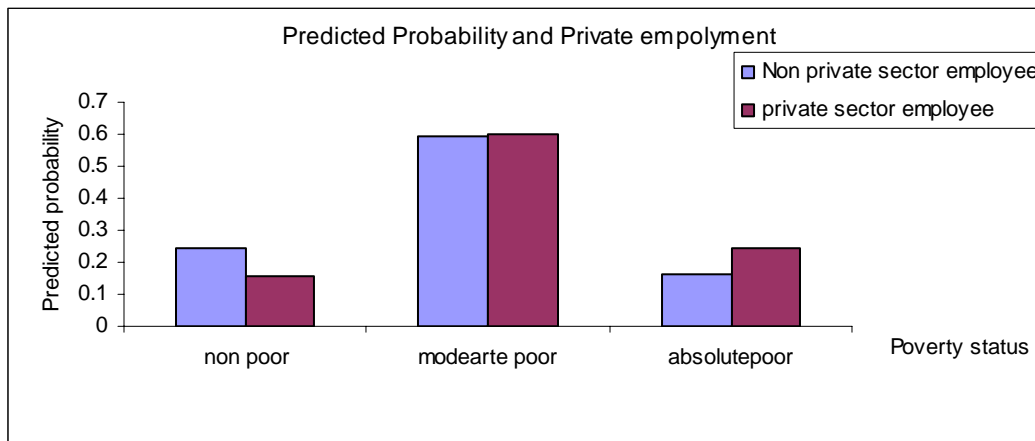
Source: Authors calculation from EHIES 1996/97.

Figure 9

The coefficient for house ownership dummy was found to be negative and significant for all categories at less than 1% level. This is in line with economic theory. Ownership of asset is really an important indicator of poverty in most developing countries. This indicator is of a paramount importance because it is household wealth
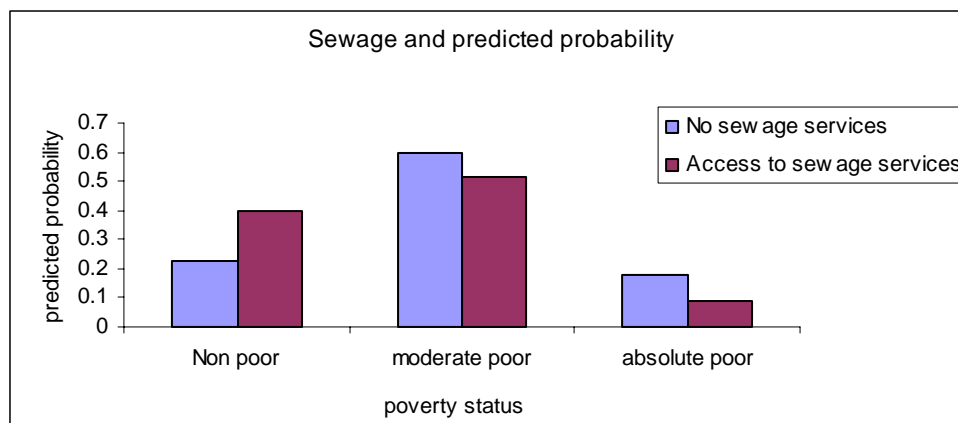

Source: Authors calculation from EHIES 1996/97.

Figure 10

which generates income flows. Figure 10 shows the effect for house ownership on the probability of being poor and non poor. It is clear from figure 10 that house ownership increases probability of being non poor where as it decreases the probability of being moderate poor and absolute poor, keeping all other things constant. More specifically it increases the probability of being non poor by more than 72 percent and decreases probability of being moderate poor and absolute poor by 9 and 34 percent, respectively. This can be explained by the fact that house ownership is a source of income, property income. Secondly house ownership saves household owners from paying huge amounts of rent which takes about two third of average income and hence enable them spend it in non house rent expenditure. According to Arneberg and Pederson (2001), property income is a major source of income for the households in the top income groups in Eritrea.

The coefficient of sewage variable which is employed as a proxy for health condition of a household is found to be negative and significant at 1% level. Access to sewage facilities is very vital for the wellbeing of a household. Lee Gravers *et al*(2001) identify that lack of sanitation facilities have negative well being effect via bad health, reduced school attendance, gender and social exclusion and income effect(reducing productivity). Our results vindicate this assertion. Figure 11 reports that access to sewage facilities decreases the probability of being moderate poor and absolute poor by about 14 and 51, percent respectively. If we turn to the non poor category, access to sanitary facilities increases the probability of non poor from that of with out access to sanitary facilities by 79 percent, keeping other things constant.

Source: Authors calculation from EHIES 1996/97.

Figure 11

The coefficient for ethnicity dummy, which takes value of one if household is Tigrigna ethnic group other wise zero, was found to be negative and significant at 1% level in all cases. This implies that a household from Tigrigna ethnic group has less probability of being in poverty that non Tigrigna household, keeping all other things
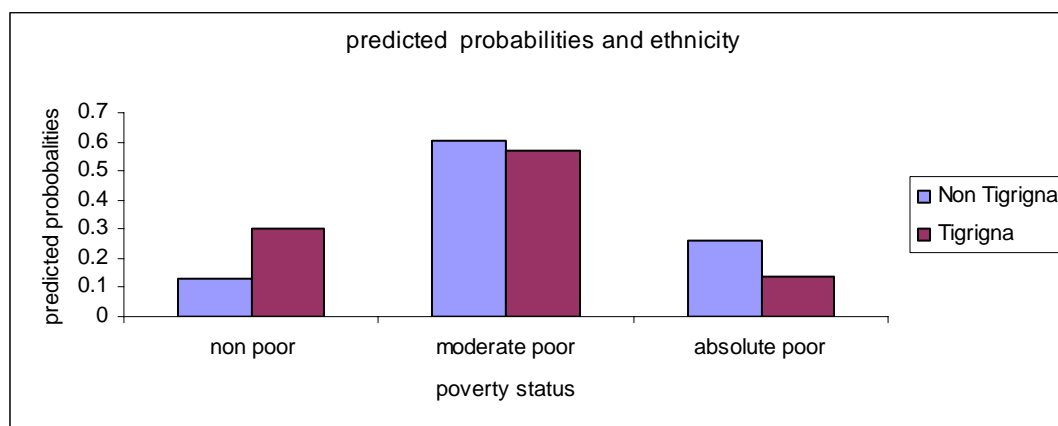
Source: Authors calculation from EHIES 1996/97.

Figure 12

the same. Figure 12 reports predicted probabilities for the three categories for Tigrigna and non Tigrigna households. It is clear from the histograms in Figure 12 that being from the Tigrigna race decreases the probability of being in the moderate poor and absolute poor, keeping al other things constant at their mean values. On the other hand the probability of being from non poor category is higher for a Tigrigna household than non Tigrigna household, keeping all other things the same. This may be explained by the relative advantage of Tigrigna races access to social and capital infrastructures. They enjoy relatively better education and other public services, which makes their opportunity to invest in schooling significantly higher than any other group. In addition, since the majority of the Tigrigna ethnic groups are located in relatively big cities, their probability of wage employment is higher. There may also be other social and other net work advantages which help them in securing job in the large cities.

Pre-independence history of a household has also effect on a household well being. The coefficient for the returnees from Sudan was only found to be positive and significance at 5 % level of significance in the moderate poor category. This suggests that the probability of being in moderate poor category is positively associated with

returnees being from Sudan, keeping all other things constant. The coefficient of dummy for pre independence ex-liberation fighter was found to be negative and significant only in the absolute poverty category at 1% level of significance. This may imply that being a liberation ex-fighter decreases the probability of being in absolute poverty category relative non poor category, keeping all other things constant. This may be explained by the different affirmative actions and privileges given to ex-liberation fighters in securing employment and acquiring party premium in the salary scale. Fissuh(2003) finds out that there is huge party membership premium in the determination of earnings in Eritrea. Arneber and Pederson (1999) also report that ex-fighters get higher earnings than non ex-fighters with same qualifications which can only be explained by political practice.

Some of the coefficients of town dummies are found to be statistically significant. The coefficients for Akurdet, Asmara, Assab, Decemhare, and Massawa are positive and significant at 1% level in both categories except the coefficient for Akurdet which is not significant in the absolute poverty category. On the other hand the coefficients of Barentu and Ghinda are negative and significant for both categories the coefficient for Keren is found to be negative and significant at 1% level only in the absolute poverty category. This may be explained by the remarkable difference in terms of unemployment, weather, and level of development and population distribution between these urban areas. The coefficient of the regional unemployment was found to be positive and significant at 1% level of significance. It suggests a positive effect of regional unemployment on poverty, keeping all other things constant. Hoover and Wallace (2001) argue that robust economic growth has a positive impact on the reduction of poverty.

CONCLUSIONS

The study uses micro level data from Eritrean Household Income and Expenditure survey 1996-97 to examine the determinants of poverty in Eritrea. It was shown in this paper that the DOGEV is an attractive model from class of discrete choice models for modelling determinants of poverty across poverty categories. This paper presents evidence of captivity of households in poverty in Eritrea. These captivities may be

explained by demand factors such as occupation and number of hours worked or some social and behavioural problems.

Household size defined by adult equivalent units has significant negative effect on the welfare status of a household. The size of the effect of household size on poverty is not the same across the categories, though. The effect is most pronounced in the absolute poverty category.

Age of household head was not found to be significant in linear terms in all poverty outcomes. However the coefficient of age squared was found to be negative and significant in the moderate poor category only. These results call further research to understand the effect of age on poverty which has a significant repercussion to the pension and other social security policies.

Even though education is negatively correlated with poverty, basic education will not suffice. The coefficient of schooling is higher (absolute terms) in the absolute poor category than in the other categories. Education is not sufficient condition to escape from poverty. This indicates that there are other factors which affect poverty of a household in conjunction with education. There is a need for providing complementary factors along side with education so as to alleviate poverty.

The probability of a household being non poor is concave function of number of employed persons per household, ceteris paribus. Besides regional unemployment rate was found to be positively associated with poverty. These results suggest labour market policies as potential instruments for tackling poverty in Eritrea. However caution is needed before adopting such a policy prescription. We need to ascertain if the people considered to be poor are employable indeed. It is possible that because of the war situation and aging population most of those who are poor and unemployed may turn out to be non employable.

Appendix

Derivation of poverty categories and definition of dummies

$$y = \frac{adjusted \quad \exp enditure \quad percapita}{regional \quad poverty \quad line}$$

The poverty variable was generated in such a way that we give more value to absolute poverty as follows:

Absolute poverty

poverty=2 if $y < 0.75$

Moderate poverty:

poverty=1   if $0.75 < y \leq 1.25$

Non poor:

poverty=0 if $y > 1.25$

Table 1Regional poverty lines

Region	poverty line with out food aid
Barka/Gash Setit	225
Semhar/Sahle	275
High Land	450
Senhit	350
Keren	450
Asmara	600
Massawa	525

Source: Eritrean Poverty assessment, World Bank (1996)
Notes: All poverty lines are rounded to the nearest multiple of 25 birr
The above figures were adjusted by 3.5 % inflation per annum before applying to the analysis.

Married= 1 if household head is married, 0 other wise.

Widowed =1 if household head is widowed, 0 other wise.

Christian=1 if household head religion is Christian, 0 other wise

Returnee from the Sudan =1 if household head returned from the Sudan after independence, 0 otherwise

Tigrigna = 1 if household is Tigrigna race, 0 otherwise

Fighter=1 if household head is liberation ex fighter

Private sector employee= 1 if household head employed in private sector, 0 otherwise.

Government employee= 1 if household head employed in government, 0 otherwise.

Self employed= 1 if household is self employed, 0 otherwise.

Transfer from relative in Eritrea= remittance from relatives with in Eritrea

Transfer from relative in Diaspora= remittance from relatives in Diaspora

No formal schooling=1 if household head has no formal schooling, 0 otherwise

Elementary=1 if household head level of education is between grade 1-7, 0 otherwise

Secondary=1 if household head level of education is between grade 8-12, 0 otherwise

Pos secondary=1 if household head level of education is above grade 12, 0 otherwise

House=1 if household owns house, 0 otherwise.

Sewage=1 if household sewage and sanitation expenditure is above 0, 0 otherwise.

Adikeih=1 if town= Adikeih, 0 otherwise

Akurdet=1 if town=Akurdet, 0 otherwise

Asmara= if town=Asmara, 0 otherwise

Assab=1 if town=Assab, 0 otherwise

Barentu =1 if town=Barentu, 0 otherwise

Decemhare=1 if town=Decemhare, 0 otherwise

Ghinda =1 if town=Ghinda, 0 otherwise

Keren=1 if town=1, 0 otherwise

Massawa=1 if town=Massawa, 0 otherwise

Table2. Descriptive statistics

Variable	Mean	Std Dev	Variance	Minimum	Maximum
Poverty	1.017	0.7835	0.6138	0	2
Age of household head	4.5617	1.5801	2.4967	1.5	9.8
Age squared	2.3305	1.566	2.4524	0.225	9.604
Remittance from with in Eritrea	0.78	1.7002	2.8907	0	36.7636
Remittance from Diaspora	0.9254	3.4686	12.0311	0	87.6101
HSIZE_A	4.247	2.4255	5.8833	1	16
FIGHTER	0.1156	0.3198	0.1022	0	1
Number of employed per household	0.9596	0.7823	0.612	0	6
Regional Unemployment rate	12.6665	4.3348	18.7904	7	20
Employee in private sector	0.0983	0.2978	0.0887	0	1
Government employee	0.1484	0.3556	0.1264	0	1
Self employed	0.2241	0.4171	0.1739	0	1
HOUSE	0.496	0.5001	0.2501	0	1
SEWAGE	0.059	0.2357	0.0555	0	1
No formal schooling	0.4898	0.5	0.25	0	1
education, Grade 1-7	0.2988	0.4578	0.2096	0	1
education, Grade 8-12	0.1377	0.3446	0.1187	0	1
Above 12 grade	0.0498	0.2176	0.0474	0	1
Number of children below age of 5	0.7433	0.9046	0.8184	0	6
Number of children between age 5-15	1.193	1.3533	1.8315	0	7
Married	0.6315	0.4825	0.2328	0	1
Widowed	0.1546	0.3616	0.1308	0	1
Adikeih	0.0474	0.2126	0.0452	0	1
Akurdet	0.0647	0.2459	0.0605	0	1
Asmara	0.2214	0.4153	0.1725	0	1
Assab	0.0805	0.2722	0.0741	0	1
Barentu	0.0636	0.244	0.0596	0	1
Decemhare	0.0466	0.2108	0.0444	0	1
Ghinda	0.0523	0.2226	0.0495	0	1
Keren	0.1344	0.3412	0.1164	0	1
Massawa	0.143	0.3502	0.1226	0	1
Christian	0.3494	0.4768	0.2274	0	1
Tigrigna	0.6633	0.4727	0.2234	0	1
Returnees from the Sudan	0.0439	0.2049	0.042	0	1

Note: The following manipulations were done to ease computation by Gauss: Age/10; Age squared/100; Remittance from abroad/1000; Remittance from Diaspora/1000.

Table 3. Percentage contribution of captive probabilities on total probabilities for selected variables

	Probabilities		
	Non poor	Moderate poor	Absolute poor
No formal education dummy=0	0.35	0.54	0.10
	0.00	*12.11*	*9.12*
No formal education dummy =1	0.13	0.58	0.29
	0.00	*11.34*	*3.30*
Elementary dummy=0	0.26	0.59	0.16
	0.00	*-11.23*	*-6.00*

Elementary dummy =1	0.25	0.60	0.15
	0.00	*10.95*	*6.53*
Secondary dummy=0	0.22	0.60	0.18
	0.00	*10.90*	*5.07*
Secondary dummy =1	0.49	0.44	0.07
	0.00	*15.03*	*12.94*
Post secondary dummy =1	0.22	0.60	0.19
	0.00	*11.02*	*5.08*
Post secondary dummy =1	0.69	0.29	0.02
	0.00	*22.26*	*47.50*
Private sector employee dummy=0	0.23	0.59	0.17
	0.00	*11.04*	*5.43*
Private sector employment dummy =1	0.26	0.60	0.15
	0.00	*10.99*	*6.46*
Married dummy=0	0.18	0.58	0.25
	0.00	*11.40*	*3.87*
Married dummy =1	0.26	0.60	0.14
	0.00	*10.99*	*6.66*
Divorced house hold head dummy=1	0.21	0.59	0.20
	0.00	*11.20*	*4.74*
Divorced house hold head dummy =0	0.23	0.60	0.18
	0.00	*11.01*	*5.35*
Tigrigna dummy =0	0.13	0.61	0.26
	0.00	*10.85*	*3.63*
Tigrigna dummy=1	0.30	0.57	0.13
	0.00	*11.60*	*7.06*
Returnee from the Sudan dummy=0	0.24	0.59	0.17
	0.00	*11.10*	*5.53*
Returnee from the Sudan dummy =1	0.16	0.69	0.15
	0.00	*9.55*	*6.34*
Fighter dummy=0	0.23	0.60	0.18
	0.00	*11.03*	*5.31*
Fighter dummy =1	0.29	0.59	0.12
	0.00	*11.07*	*7.94*
Private sector employee dummy=0	0.24	0.60	0.17
	0.00	*10.99*	*5.68*
Private sector employee dummy=1	0.21	0.59	0.20
	0.00	*11.14*	*5.00*
Government employee dummy=0	0.24	0.59	0.16
	0.00	*11.05*	*5.74*
Government employee dummy =1	0.16	0.60	0.24
	0.00	*10.88*	*3.90*
House ownership dummy=0	0.18	0.62	0.21
	0.00	*10.64*	*4.52*
House dummy=1	0.30	0.56	0.14
	0.00	*11.69*	*6.88*
Captivity element	**0.00**	**0.07**	**0.01**

Note: Percentage contribution of captivity elements in bold italics under total probabilities.

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