Dimensions and Determinants of Agro-Pastoral Households' Poverty in Dembel District of Somali Regional State, Ethiopia

Shibru Tessema Muktar[1] Jema Haji Mohamad[2] Yohannes Mengesha Woldemichael[3]
1. Graduate Student of Agricultural Economics at Haramaya University
2. Associate Professor of Agricultural Economics at Haramaya University,
3. Development Research and Business Consultant (Freelance)
(ETHIOPIA)
shebe.tes@gmail.com; jemahaji@gmail.com; fev_eris@yahoo.com

Abstract
Poverty reduction strategy is one of the top priority agenda of developing countries like Ethiopia. Hence, this study investigates the dimensions and determinants of agro-pastoral households' poverty in Shinille zone of Somali regional state. It is based on information gathered from 240 randomly selected households in Dembel district. The Foster, Greer and Thorbecke (FGT) Poverty Indices are employed to examine the extent and severity of the agro-pastoralists' poverty in the study area. The survey outcome revealed that 67% of the sample households in the district live below the poverty line. In identifying the determinants of poverty, a binary logistic regression model was employed. Results show that access to irrigation, distance from market center, farm land size, non-farm activities, educational status, livestock holding, and herd diversification had a significant effect on the probability of a household to be poor.

1. INTRODUCTION

1.1. BACKGROUND OF THE STUDY

Agriculture is the backbone of the Ethiopia's economy it contributes about 50% to overall GDP, generates 90% of export earnings and supplies about 70% of the country's raw materials to the secondary activities (MoFED, 2008). Although the contribution of the sector to the national economy is high, its performance is not that satisfactory. Due to poor performance of the Sector, poverty, inequality and food insecurity are the most crucial and persistent problems in Ethiopia (Yilma, 2005). Accordingly, Human development indicators of the United Nations Development Programme (UNDP) also attest to the seriousness and extent of poverty in the country. For instance, the multidimensional poverty index (MPI) of Ethiopia is the second lowest out of 104 countries in the world (UNDP, 2010). Based on the report 90 percent of the people are poor in Ethiopia.

The MoFED (2008) report using a consumption-based measure of poverty, estimated that 27.5 million people of the population were poor in 2004/05, living below the poverty line. This means that they are unable to lead a life fulfilling the minimum livelihood standard. Economic development in Ethiopia has unsatisfactorily over years and as a result the country has been caught in a ''vicious circle'' of poverty. The situation leads to low savings and investment capacity as a result of low level of income comes from low productivity that in turn leads to poverty. Poverty stills a major problem in most of developing countries, especially in sub-Saharan Africa.

Millions of poor people in Ethiopia live in semi-arid agro-pastoral and pastoral areas have suffered extreme marginalization and food insecurity because of reduced access to pastureland, and in some places steadily extending croplands. The lack of institutional support for the pastoralists has further excluded their participation in decision making (Ayalneh *et al*., 2006).

In Somali regional state, the problem of poverty is similar. According to Fikirte (2008), recurrent drought is a major concern in the region resulting in reduced forage supply, herd mortality, food insecurity and poverty. Furthermore, due to intensive grazing, over the carrying capacity of the land, there is a disappearance of most palatable, digestible and high yielding species, which in turn results in a loss of potential grazing land. Generally poverty has become the picture of Dembel district for the last two decades. Even though food aids have been donated frequently, systematic attempts have not yet been made in the district so far. Therefore, even if, poverty reduction is not a simple task, a meaningful formulation and implementation of poverty reduction strategies require an area-focused research.

In this context, this study is initiated to identify and characterize the dimensions of poverty in the district, by using the household level of consumption expenditures and constructing poverty profile using method of cost of basic needs. In addition, identifying the determinants of poverty in the study area is the primary concern of the study.

1.2. OBJECTIVES OF THE STUDY

The general objective of the study is to assess the dimensions and determinants of agro-pastoralist households' poverty in Denbel district of Shinile Zone, Somali Regional State.

The specific objectives of the study are:

- To examine the dimensions of poverty in agro-pastoral community in the study area and
- To identify factors affecting poverty among agro-pastoralist households in the district.

2. METHDS

2.1. Description of the Study Area

The Somali regional state of Ethiopia is located between 4-11^{0}N and 40-48^{0}E, within the eastern and southeastern lowlands of Ethiopia. It borders the Republic of Djibouti in the north, the Somali republic in the east, Oromiya region from south to northwest, and the Afar region in the north and northeast of the country. The total land area is about 327,000 km^2, equivalent to 30% of the national land area (Amaha, 2006). According to the 2007 CSA census, the population of the region was estimated to be 4,439,147 out of which 621,210 live in the urban areas while the remaining 3,817,937 live in the rural parts. This indicates only 14 % of the population live in urban areas.

Shinile Zone is situated in the North Western part of Somali National Regional State (SNRS). Agro-pastoralism predominantly inhabits the region whereas Pastoralists have also been noted to some degree. The zone is divided into six districts namely, Mieso, Afdem, Erer, Shinile, Aysha and Denbel. The altitude of the Zone ranges between 530-1350 meters above sea level

Denbel is one of the six districts of the Shinile zone .The district has 28 kebeles under it. And it is boarded by Aysha to the North, Awbare to the East, Shinile to the West, Jijiga to the South and Oromia and Dire Dawa council to the southwest (SC-UK, 2009).

2.2. Method of Sampling

In this study a two-stage sampling procedure was adopted for the selection of the desired sample respondents. The first step was identifying the agro-pastoral kebeles from pure pastoral ones then to select the households in the study area. Among 28 kebeles in the district 12 of them belongs to pure pastoralists and the rest are agro-pastoralists kebeles. From the agro-pastoral kebeles only four were selected purposively based on accessibility, security situation and representativeness of the kebeles for the study. Accordingly, a total of 240 sample households were randomly selected from four kebeles using probability proportional to sample size techniques.

2.3. Methods of Data Analysis

2.3.1. Determination of Poverty Line

To measure households' poverty status, this study adopted the cost of basic needs approach which is widely used for setting the poverty line, based on the estimated cost of the bundle of goods adequate to ensure that basic needs are met.

Steps to determine the poverty line

$$S_i = \alpha + \beta \log\left(\frac{Y_i}{Z^f}\right) + \varepsilon_i \quad (1)$$

Where S_i = food share
Y_i = total expenditure
Z^f = food poverty line

For those households whose total expenditure is approximately equal to the food poverty line ($Y_i \approx Z^f$), the food share is α, and consequently the non-food share of expenditure is (1-α). Thus the poverty line is

$$Z=Z^f + Z^{nf} \quad (2)$$

Where: Z^{nf} non-food poverty line

$$Z= Z^f + (1- \alpha) Z^f \quad (3)$$

$$Z= Z^f (2-\alpha) \quad (4)$$

This line enables us to identify sample households as poor or non-poor.

On the other hand, to examine the dimension of poverty, the FGT poverty measures were employed. These include, the Headcount index, Poverty Gap index, and Poverty Severity index.

The mathematical expression of the model is given by:

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{Z - I}{Z}\right)^\alpha \quad (5)$$

Where; P_α = the measure of poverty index
z = the poverty line
I = the mean income of the poor found below the poverty line
N = population size
q = the number of poor households
α = Poverty aversion parameter

The weight given or attached to the severity and sensitivity of the poor where $\alpha \geq o$, and the commonly used values of α are 0, 1 and 2. For $\alpha = 0$, all poor are given equal weight and P_0 = Head Count index; for $\alpha = 1$, each household is weighted by its distance to the poverty line and P_1 is Poverty Gap that measures the distance to the poverty line; and for $\alpha = 2$, the weight given to each household is more than proportional to the shortfall from the poverty line and it is squared poverty gap index.

In addressing the second objective of the study, which is to identify the determinants of household poverty status in the study area, the binary logistic regression model was employed. In the model, the dependent variable takes a value of 1 if the household is below poverty line, i.e. poor with the probability of P_i and otherwise takes a value of 0, i.e. non-poor with the probability of $1\text{-}P_i$.
Specification of the model is as follows.

$$P_i = F(Z_i) = F(\alpha + \sum_{i=1}^{m} \beta_i X_i) = \frac{1}{1 + e^{-Z_i}} \tag{6}$$

$$Z_i = \alpha + \sum_{i=1}^{m} \beta_i X_i \tag{7}$$

Where; P_i = the probability that a household is poor
i = 1, 2, 3 …m
e = base of natural logarithms (2.718)
X_i = explanatory variables
m = number of explanatory variables
α = intercept
β_i = coefficient of explanatory variables.

Thus $1 - P_i$ is the probability of the household being non-poor, that is given by

$$1 - P_i = \frac{1}{1 + e^{Z_i}} \tag{8}$$

Hosmer and Lemeshaw (1989), pointed out that the logistic model could be written in terms of the odds and log of odds, which enables one to understand and interpret of the coefficients.
Therefore

$$\left(\frac{P_i}{1 - P_i}\right) = \left(\frac{1 + e^{Z_i}}{1 + e^{-Z_i}}\right) = e^{Z_i} \tag{9}$$

This implies

$$\left(\frac{P_i}{1 - P_i}\right) = \left(\frac{1 + e^{Z_i}}{1 + e^{-Z_i}}\right) = e^{Z_i} = e^{\left(\alpha + \sum_{i=1}^{m} \beta_i \chi_i\right)} \tag{10}$$

The above model can be represented in terms of logarithms as follows:

$$\ln(e^{Z_i}) = Z_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_m X_m \tag{11}$$

If the disturbance term, (U_i) is taken into account, the logit model becomes

$$Z_i = \alpha + \sum_{i=1}^{m} \beta_i X_i + \mu_i \tag{12}$$

The coefficient of the logit model represents the change in the log of the odds associated with a unit change in the explanatory variable.

Table1. Definition of explanatory variables and units of measurement

Code	Type	Definition of Variables
HHSEX	Dummy	Sex of the household head: 1 if the head of the household is male; 0, otherwise.
HHAGE	Continuous	Age of the household head in years
HHEDU	Dummy	Household head education status; 1 for literate HH head; 0, otherwise
FSIZE	Discrete	Family size in the household
DEPRAT	Continuous	Dependency ratio in percent
LIVSOWN	Continuous	Livestock ownership in TLU
OXENOWN	Discrete	Number of oxen owned
NONFARIN	Dummy	Non-farm income; 1 if member of the household participate in non-farm activity; 0, otherwise
DISTMKT	Continuous	Distance from market centers in hours
ACCI	Dummy	Access to irrigation; 1 if the household participate in irrigation scheme and 0, otherwise
DIVHERD	Discrete	Number of breeds owned by the HH
LSIZE	Continuous	Household land size in *qodi* (1 *Qodi* = 1/5 Ha).

Source: Own definition, 2011

3. FINDINGS

3.1. ESTIMATION OF POVERTY LINE

As already been discussed above, the cost of basic needs approach (Ravallion, 1994) was used to construct households' poverty levels. This involves a series of steps. First, the researchers used the collected data to construct a typical diet for the poorest half of the sample as a reference group to determine the quantities of their basic food items that made up the reference food basket using expenditure share. These expenditure shares were then converted into calorie shares, using standard calorie conversion factors. The resulting diet is recalculated to obtain 2200 Kcal per day per adult which is the recommended minimum requirement according to WHO.

To obtain the minimum level consumption, the quantities of each food item in their diet were valued in terms of birr. The total value of the food basket constitutes the food poverty line. Based on the cost of 2,200 Kcal per day per adult for the food poverty line calculated from the data available is found to be 1522 birr per adult per year (about $84.56 per year). Table 2 gives details on the diet implied by the data and the resulting food poverty line. It was found that about 84 percent of the HH calories come from cereals. In terms of expenditure, cereals are more than 60 percent of the value of consumption in the study area.

Table 2. Typical diets and contribution to the food poverty line

Food item	Mean Kcal/Kg (per Li)	Calorie share(percent)	Amount of Kcal/day/AE	Value of poverty line	Value of poverty line/AE/day	Expenditure share
Cereals	3646	84	1848	2.53	925	60.8
Oil	8964	10	220	0.69	250	16.4
Sugar	3850	5	110	0.57	208	13.7
Salt	231	1	22	0.38	139	9.1
Total		100	2200	4.17	1522	100

Source: Own survey result, 2011

Using equation 2, the non-food share of the poverty line was estimated by regressing the food share of those households whose total consumption expenditure is between 80 and 120 percent of the food poverty line on the log of the ratio of consumption expenditures to the food poverty line. This is in order to give more weight to those households closer to 100 percent of the food poverty line.

From the regression analysis the food share $\alpha = 0.69$ implies that the households' pattern of expenditure is 69% for food and 31% for their non-food need. This means that poverty line for non-food need is 31% of the total expenditure. It is known that mean expenditure of these households approximately equal to the food poverty line ($Y \approx Z^f$). Thus, the non-food need is equivalent to 31% of the food poverty line. Based on this the non-food allowance for the poverty line is given by birr 472.

Here α and $1-\alpha$ are food share and non-food share of those households which spent in the neighbourhood of food poverty line (1522 birr). The basic assumption here is that mean total expenditure approximately equal to the food poverty line.

Based on the CBN approach, the researcher estimated the district's poverty line as follows:

$$Z = Z^f (2 - 0.69)$$

$Z = Z^f(1.31)$ =1522*1.31=1994 Ethiopian birr

Finally, the poverty line in the Denbel district is birr 1994 which enable us to identify a sample household as poor or not.

3.2. DIMENSIONS OF POVERTY

Once the above poverty line is established, the next step was to calculate poverty indices, which help to see the incidence and severity of poverty in the study area. Accordingly, the poverty indices were calculated using the FGT measures of poverty. Table 3 shows estimated poverty indices which are poverty head count, poverty gap and poverty severity in the study area.

Table 3. Absolute poverty indices based on sample agro-pastoralist households

Poverty indices	Index values
Head count index $(\alpha = 0)$	0.67
Poverty gap $(\alpha = 1)$	0.34
Poverty severity $(\alpha = 2)$	0.17

Source: Own survey result, 2010

The resulting poverty estimate for the study area (Table 3) shows that the percentage of poor people measured in absolute head count index (α = 0) is about 67%. This figure indicates that the proportion of the sampled agro-pastoral households in Denbel district live below absolute poverty line. This implies that 67% of the population are unable to get the minimum calorie required (2200 kcal per day per adult) and essential non-food expenditure. Putting differently, these much proportions of agro-pastoralists are unable to fulfill the minimum amount of consumption expenditure that is, Birr 1994 per adult equivalent per year.

The poverty gap index (α=1), a measure that captures the mean aggregate consumption shortfall relative to the poverty line across the sample households is found to be 0.34 which means that the percentage of total consumption needed to bring the entire population to the poverty line is 34%. This indicates if the district mobilizes resources that can meet 34 percent of caloric need of food insecure households and distribute to each household, then theoretically food insecurity can be eliminated.

Similarly, the FGT severity index (the squared poverty gap, α=2) in consumption expenditure shows that 17% fall below the threshold line implying severe inequality. It means that there is a high degree of inequality among the lowest quartile HHs.

3.3. DETERMINANTS OF POVERTY

In identifying factors that determine the households' poverty status, a set of 12 explanatory variables were included in the binary logistic regression analysis. These variables were selected on the basis of theoretical explanations and the results of various empirical studies.

To determine the best subset of explanatory variables that best predicts the dependent variable, multicollinearity problems were checked for all explanatory variables prior to running the model.

Table 5. Estimation of the binary logit model

Variables	Odds ratio	Z-value	P-value
HHSEX	0.294	-0.79	0.430
HHAGE	1.104	1.09	0.277
HHEDU	0.533*	-1.68	0.092
FSIZE	1.256	1.11	0.267
DEPRAT	10.629	1.38	0.167
LIVSOWN	0.085*	-1.65	0.099
OXENOWN	0.292*	-1.84	0.066
NONFARIN	0.028**	-2.52	0.012
DISTMKT	3.193***	2.90	0.004
ACCI	0.032***	-3.21	0.001
DIVHERD	0.152*	-1.80	0.072
LSIZE	0.166**	-2.00	0.046
-2 Log Likelihood		18.000	
Pseudo R^2		0.878	
LR chi2(12)		132.880	
Prob > chi2		0.000	

*Note: *, ** and *** are statistically significant at 10%, 5% and 1% level respectively.*
Source: Own survey result, 2011

As can be seen in the Table 5, out of the twelve explanatory variables, eight variables were found to have significant effect in determining the status of the household poverty. These variables are education, land

size, access to irrigation, livestock ownership, number of oxen owned, non-farm income, distance from market center and diversification of herd. According to the model results, the remaining four variables, namely age, sex, family size and dependency ratio were found to have no significant influence on poverty status of the households in the study area.

For instance, the odds of 0.533 for education status of the household head imply that, other variables being constant, the probability of being poor decreases by a factor of 0.533. The odds ratio of 0.166 for total land holding implies that, other things kept constant, the odds of being poor decreases by a factor of 0.166 when land size increase by one *qodi*. Participation in irrigation scheme resulted a decrease (by a factor of 0.032) in the odds of being non-poor. The odds ratio of livestock ownership show that, the odds in favour of poor decreases by a factor of 0.085 as TLU increase by one unit.

Similarly, the odds ratio of the number of oxen owned shows that, other variables being constant, the odds ratio in favour of poor decreases by a factor of 0.292 as the number of oxen owned increases by one. Regarding the variable, non-farm income, the odds ratio indicates that, other things being constant, the odds of being poor decreases by a factor of 0.028 if one of the members of the household participates in non-farm income generating activity. Furthermore results also indicate that the odds ratio in favour of poor increases by 3.193, if market distance increases by one hour, *citrus paribus.* The odds ratio of herd diversification shows that, other variables being constant, the odds in favour of poor decreases by a factor of 0.152 as the number of herd diversification or breed increases by one.

4. CONCLUSION AND RECOMMENDATION

Overall, the study concluded that poverty in the study area is deep-rooted and widespread. The level and nature of poverty is also directly related to the poor agricultural performance which is highly dependent on unreliable weather conditions. The households' poverty status could be affected by households' characteristics such as distance from market center and participation in irrigation schemes. Access to irrigation helps the household to secure food and income for their basic need. In fact irrigation scheme is not well practiced activity in the area despite high availability of potentially irrigable land and water resources.

In addition, household's livestock holding is also found to have ability in escaping poverty by providing food and cash for the household. The study findings on non-farm income activities also have become helpful income source and able to determine household poverty status. This indicates that a household could secure the income for basic necessities by participating in alternative options of non-farm income generating activities.

Hence, introduction of alternative income generating activities will have paramount importance in ensuring food security in the study area. Organizations intervening on projects like woman's petty trading activities should be encouraged to target poor on their interests of non-farm activities.

Even though livestock production is impeded by various constraints including food supply, disease, and institutional and policy factors, due emphasis should also be given to improve production and productivity of livestock sector. Thus, to increase feed availability and quality, some package activities such as rehabilitation of available natural feed (rangeland) through area closure and rotational grazing are need to be introduced. Appropriate feeding practice such as supplementary feeding (for instance multi nutrient block) could be suitable and also need to be introduced for agro-pastoralists. Policies on introduction of improved animals (which could highly productive, cope with the existing environment and tropical diseases), on livestock market, to the agro-pastoral areas are also very essential and need to be designed.

Improving school enrolment through implementing different integrated practice are possible policy alternatives. International development agencies and Governments should commit financial and other resources to education for agro-pastoral communities to develop their capacities to achieve their sustainable development and poverty reduction strategies.

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