Statistical Analysis of Factors Affecting Poverty Status of Rural Residence

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Abstract: Poverty is one of the serious problem affect the life of peoples in third world countries. Identifying major factors affecting poverty status of a society is important to decide what action should be taken to alleviate the poverty. The aim of this paper is to assess the factors that affect the poverty status of rural Residence in the study area. A cross-sectional study was conducted in five districts of Gamo Gofa zone, Southern Regional State of Ethiopia. From a total of households in these areas, 4092 were selected using stratified random sampling technique. Data were collected with a well designed questionnaire. If the welfare of a household is below the poverty line, the household is categorized as under poverty and if it is above poverty line, then the household is above poverty. Binary logistic regression model was used to analyze the data using the SPSS software. Several risk factors were found to be significant at the level of 5%. Saving culture, access to credit, resource base, land fertility, use of agricultural inputs, use of improved tools, availability of rain, land topography, labor availability and dependency attitude have significant association with the poverty status of a households. Governments and Non-Governmental organization should be aware of the consequences of these factors which can influence the household income and future poverty status.

Keywords: Poverty, Household, Logistic Regression, Poverty Status and Poverty Factors

1. Introduction

Poverty is one of the major problems in the world. It is very serious in the third world like Ethiopia that needs a crucial attention. Thus, “Eradication of extreme poverty and hunger” was set to be the first priority of Millennium Development Goal (MDG). It was targeted to reduce by half the proportion of people whose income is less than US$1 per day between 1990 and 2015. In 2000, the World Leaders were committed themselves to the Millennium Development Goals (MDGs) [1]. The proportion of people living with poverty in Sub-Saharan Africa is the highest one in the world, which is followed by Southern Asia. UN (2007) reported that the MDG was only achieved the reduction of the proportion of people living in extreme poverty in 2004 from 46.8% to 41.1% in Sub Saharan Africa. The poverty gap ratio fell from 19.5% to 17.5%. Majority of Ethiopian People, as it is in Sub Sahara, are categorized with the poorest nations in the World.

The Human Development Report (HDR) reported that over 80% of the population survives on less than US$ 2 per day [2]. The most recent World Development Report of 2007 calculated a per capita income of US$ 160 for Ethiopia and in the Human Development Index (HDI) Ethiopia was ranked 170th out of 177 nations with HDI value of 0.371 [3, 4]. The studies by [5, 6] reported that between 35 to 50% of the population was found to be poor. Previous studies of poverty in Ethiopia have generally focused on rural rather than urban areas [7-9]. This is due to the fact that around 85% of the population lives in rural areas. In addition to this, unfavorable weather fluctuations may take a heavy toll on the lives of rural farmers and bring them to the brink of starvation. This made rural famine prevention and poverty reduction a priority of both governmental and non-governmental agencies. However; there was a study on urban area of the country by which showed that poverty in urban Ethiopia was quite high with an overall head count index of 47.2% in 1994 and 40.4% in 2000 using the additively decomposable FGT measures [10]. The cities of Mekelle,
Hawassa and Dessie were the poorest in 1994 whereas Dire Dawa and Bahir Dar were the least poor. Between 1994 and 2000, the poverty situation in Hawassa and Mekelle were significantly improved while that in Dire Dawa was worsened. The improvements in Addis Ababa and Bahir Dar were also quite remarkable.

The study by [11] revealed that nearly 40% of the sampled households from three rural districts of Ethiopia (Alemaya, Hitosa and Merhabete) were living below poverty line with an average poverty gap of 0.047. According to the researcher, the areas were purposively selected to represent major farming systems in Ethiopia. The finding by [12] was also indicated that the incidence of rural poverty is high for villages that have lower conditions for agriculture. The comparison study between rural and urban poverty using the 1994 rounds of the ERHS and EUHS by deriving different poverty lines was made, since household needs, prices and tastes across rural and urban area is different [6]. The Cost of Basic Needs Approach described in Ravallion and Bidani [13] was used by them in estimating the poverty lines. Their findings suggested that urban poverty was much higher than rural poverty when region specific food baskets were used. The government’s 2004/2005 Household income and Consumption Expenditure Survey indicated that the incidence of poverty was higher in rural compared to urban areas with the poverty head count ratio being 39.3% and 35.1% respectively [14].

There are no detail studies on poverty at a regional level in SNNPR, especially in Gamo- Gofa zone in order to address the poverty status and determinant factors. To achieve MDGs, decreasing poverty by half in 2015, identifying causes and determinants of poverty in rural areas of a country is very important. Identifying and determining poverty factors can be used as source of information for further studies and will help police maker to set an appropriate measurement towards poverty reduction. Thus, this study was tried to identify the major factors affecting poverty status of rural residences of the study area in Gamo Gofa Zone in SNNPR part of Ethiopia.

The economic development of a country depends on poverty status of its people. The welfare of a society can be affected by different factors. These factors make hard for them to fulfill their basic needs. Identifying major factors affecting poverty status of a society is important to decide what action should be taken to alleviate the poverty. The main goal of the study is to assess factors that affect the poverty status of rural residence in the study area.

2. Methods

The study conducted in the Gamo-Gofa Zone, Southern Nations, Nationalities and people region of Ethiopia. A cross-Sectional survey was conducted with a stratified sampling technique on 4092 samples from the total population of 99,132. Data were collected using well designed questionnaire which contain information on demographic factors, socio-economic variables, agricultural resource and technology use.

The response variable of the study was poverty status of a household. If the welfare of a household is below the poverty line, the household is categorized as under poverty and if it is above poverty line, then the household is above poverty. The explanatory variables, such as Sex of households head, Age of household head, Number of household members in Adult equivalent (AE), Age dependency ratio, marital form, Educational status of the head were considered as variables of Household Characteristics. Socio-economic Variables (Participation and active membership in different institution, saving habit of household, Access to credit, Poor resource base), Health factors (Health care facility and Distance from health care center). Economic and agricultural factors (Land owned by household, Size of cultivated land, Land fertility, Farm product price, Price of inputs, Household labor availability, Total livestock ( in TLU), Total non-farm income, Distance from nearest market), Other (Farmer attitude of dependency, Technology adoption, Availability of rain (water), and Land topography),

3. Logistic Regression Model

The response variable is poverty status of the residents, denoted by Y, which is dichotomous with outcome either below poverty (y=1) with probability \( \pi_i = p(Y_i = 1|X) \) or above poverty (y=0) with probability1- \( \pi_i = p(Y_i = 0|X) \). The conditional probability that a household head is below poverty (success) given the \( X_i \) set of predictor variables is denoted by \( \pi_i = \text{prob}(Y_i|X_i) \). The logistic regression model is given as: [15]

\[
\pi_i = \frac{e^{\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_p x_{ip}}}{1 + e^{\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_p x_{ip}}}
\]

and equivalently expressed with the logit link function as

\[
\log it(\pi_i) = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \ldots + \beta_p X_{ip}
\]

where \( i = 1,2,3, \ldots, n, j = 0,1,2, \ldots, p, X_{ij} \) the \( i \)th Predictors of \( i \)th households, \( \beta_0 \) is an intercept \( \beta_j \)'s are coefficients of the predictors variable

Estimation of the Parameters

The likelihood function \( L(Y|X, \beta) \) is defined as the joint probability distribution \( f(y|X, \beta) \) of the independent observation
observations is expressed as:

$$L(Y|X, \beta) = \prod_{i=1}^{n} \left( \frac{e^{\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_p x_{ip}}}{1 + e^{\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_p x_{ip}}} \right)^{y_i} \left( \frac{1}{1 + e^{\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_p x_{ip}}} \right)^{1-y_i}$$

It refers to how likely a particular population is to produce an observed sample given the parameter values. The estimation of parameters is based on the maximum likelihood method, with Newton–Raphson iterative search algorithm to maximize the likelihood function or its logarithmic transformation [15]

4. Result and Discussion

4.1. Descriptive Statistics Result

The descriptive statistics shows minimum and maximum number of household was 1 and 12 (0.80 and 10.9 in adult equivalent scale (AES)) respectively and the average number of household was 5.7397 (4.7975 in AES); the average dependency ratio of households was 691.04. The average land owned by a household in the zone was 1.7946 hectar. The average employment of household was 5.7397 (4.7975 in AES) with standard deviation of 2.21 (1.811 in AES); the average dependency of households under poverty was 36.7%. The cross tabulation result given in table 1 showed association and the proportion of each predictor variable against the response variable using test statistics Chi-square and likelihood ratio. Accordingly the household that had saving culture been 62.4%, but 37.6% didn’t. 34.7% of the household had access to credit while 65.4% didn’t. The household that has dependency attitude was 81.0%. The data revealed that only 61.7% and 10.6% use agricultural inputs and improved tools respectively.

The result from Table 1 showed that there was significant association between response variable poverty status and explanatory variables such as saving culture, access to credit, resource base, land fertility, use agricultural inputs, use of improved tools, availability of rain, land topography, labor available, and dependency attitude. Whereas the other response variables like access to market didn’t have significance association with response variable.

| Variable                | Category | Above poverty count | % | Under poverty count | % | Total count | % | Chi-square (sig.) | Likelihood Ratio (sig.) |
|-------------------------|----------|---------------------|---|---------------------|---|-------------|---|-------------------|------------------------|
| Saving culture          | Yes      | 1424                | 55.0| 1131                | 75.3| 2555        | 62.4| 168.486 (0.000) | 73.929 (0.000)         |
| Access to credit        | No       | 1167                | 45.0| 370                 | 24.7| 1537        | 37.6| 258.00 (0.000) | 254.802 (0.000)        |
| Access to market        | Yes      | 664                 | 25.6| 757                 | 50.4| 1421        | 34.7| 0.100 (0.752)   | 0.100 (0.783)          |
| Resource base           | No       | 1927                | 74.4| 744                 | 49.6| 2671        | 65.3| 108.72 (0.000) | 118.791 (0.000)        |
| Land fertility          | Yes      | 599                 | 19.6| 301                 | 20.1| 810         | 19.8| 4.185 (0.041)  | 4.211 (0.040)          |
| Use agricultural inputs | No       | 2082                | 80.4| 1200                | 79.9| 3282        | 80.2| 419.12 (0.000) | 417.69 (0.000)         |
| Use of improved tools   | Yes      | 2206                | 72.1| 1383                | 92.1| 3425        | 84.4| 105.00 (0.000) | 119.56 (0.000)         |
| Availability of rain    | No       | 868                 | 26.5| 882                 | 58.8| 1760        | 38.3| 200.00 (0.000) | 210.00 (0.000)         |
| Land topography         | No       | 686                 | 26.5| 882                 | 58.8| 1760        | 38.3| 200.00 (0.000) | 210.00 (0.000)         |
| Labor available         | Yes      | 2217                | 85.6| 1439                | 95.9| 3656        | 89.4| 105.00 (0.000) | 119.56 (0.000)         |
| Dependency attitude     | No       | 2217                | 85.6| 1439                | 95.9| 3656        | 89.4| 105.00 (0.000) | 119.56 (0.000)         |
| Access to non-farm employment | Yes        | 1069                | 41.3| 295                 | 19.7| 1364        | 33.3| 200.00 (0.000) | 210.00 (0.000)         |
| Employment              | No       | 1069                | 41.3| 295                 | 19.7| 1364        | 33.3| 200.00 (0.000) | 210.00 (0.000)         |
4.2. Multiple Logistic Regression Analysis Result

Before discussing the result obtained from the model, the adequacy of the model should be assessed or checked. Likelihood ratio (LR) tests, R² statistics, Hosmer-Lemeshow test and classification table were used to check the adequacy of the model.

LR test is a test of the significance of the difference between the likelihood ratios for the researcher’s model (null model) and the likelihood ratio for a reduced model (null model).

The hypothesis to be tested to the overall fit of the model was:

H₀: The model is a good fitting to the data Vs. H₁: The model is not a good fitting to the data

The likelihood ratio test (deviance) was applied to the difference between the null and the final model. The result from the analysis showed -2LogLikelihood value for null model and final model was 5213.724 and 3951.801 respectively. Model chi-square value was 1631.012 with 17 degree of freedom and the probability p=0.000. This indicates the final model was a good fit, which showed that the predictor variables had a significant effect at 5% levels of significances. From the Hosmer-Lemeshow test statistics analysis it was obtained the chi-square test statistic 7.220 with 0.513 p-value. Therefore the model was quite a good fit, because p-value exceeds 0.05. There is no difference between the observed and predicted model value. Hence, the estimated model fit the data well.

Result from classification table 81.1% of the sample households which were included in the model was correctly predicted. The sensitivity was 84.6% and the specificity was 76.3% which indicated 76.5% of below poverty line and 84.6% of above poverty line were correctly predicted in their respective categories.

| Predictors                  | Beta  | S.E (β)  | Wald | df  | Sig. | Exp'(β) |
|-----------------------------|-------|----------|------|-----|------|---------|
| Constant                    | -0.655| .552     | 43.859| 1   | .000 | .026    |
| Dependency ratio            | .004  | .001     | 36.214| 1   | .000 | 1.004   |
| HH size in AES              | .613  | .031     | 400.340| 1   | .000 | 1.846   |
| Saving culture              | .415  | .097     | 18.434| 1   | .000 | 1.514   |
| Access to credit            | .438  | .088     | 24.897| 1   | .000 | 1.549   |
| Resource base               | .798  | .131     | 37.314| 1   | .000 | 2.201   |
| Dependency attitude         | -.698 | .114     | 37.306| 1   | .000 | .497    |
| Land owned by household in hectar | -.247 | .032     | 58.681| 1   | .000 | .781    |
| land fertility              | .017  | .112     | 0.23  | 1   | .879 | 1.017   |
| Market access               | .745  | .132     | 31.913| 1   | .000 | 2.107   |
| HH labor availability       | .323  | .095     | 11.605| 1   | .001 | 1.382   |
| Number of livestock in TLU  | -.147 | .016     | 84.792| 1   | .000 | .863    |
| Use of agricultural inputs  | 1.384 | .095     | 212.068| 1  | .000 | 3.990   |
| Use of improved tools       | .469  | .181     | 6.752 | 1   | .009 | 1.598   |

The result in Table 2 showed the output for logistic regression model. The odds ratio of household size implies that, as the household size increases by one AES unit, the odds of a household being under poverty increased by 84.6%. From the odds ratio of household dependency ratio it can be observed that as the dependency ratio increased by one unit, the odds of being under poverty decreased by 0.4%. Household that had no saving culture was 1.514 times more likely to be under poverty than those households that had saving culture. It means that the odds of a household being under poverty increased by 51.4%. Households that had access to credit were also 0.549 times less likely to be under poverty than those households that did not have the access. It mean that household with no access to credit, their odds of being under poverty was increased by 54.9%. Households with no resource base were 2.201 times more likely to be under poverty than those with good resource base. That is their odds of being under poverty increased by 120.1%. Dependency attitude of the household was also one of the significant predictor variables. Its odds ratio indicated that the odds of households with no dependency attitude was 0.497 times less likely to be under poverty than the reference group (those with dependency attitude). As a land owned by a household increased by one hect, the odds of being under poverty decreased by 21.9%. This told us that as the land size increased by one TLU the risk their being under poverty was decreased. This is due to the fact that households that have larger land have a chance of escaping from being under poverty (as they can get more products from it). The result is consistent with the findings [17, 18, 20].
5. Conclusion

Based on the collected data from the study area, proportion of households under poverty was 36.7%. From bivariate analysis: Saving culture, access to credit, resource base, land fertility, use of agricultural inputs, use of improved tools, availability of rain, land topography, labor availability and dependency attitude have significant association with the poverty status of a households. The result of logistic regression showed that variables: dependency ratio, household size in AES, saving culture, access to credit, resource base, dependency attitude, land owned by household in hectar, use of improved tools, household labor availability, number of livestock in TLU, use of agricultural inputs and market access have significant effect on the poverty status of household of in the study area based on the collated data from the study area. Based on identified factors, the researchers recommend that awareness on saving culture should be created for households under poverty; dependency attitude of the household should be changed by concerned bodies. The use of improved tools and agricultural inputs decreases likelihood of a household being under poverty, the farmer should be encouraged using them. Households should have a good market access for their product.

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