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Full Length Research Paper

Determinants and its extent of rural poverty in Ethiopia: Evidence from Doyogena District, Southern part of Ethiopia

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This study identifies the extent and determinants of rural poverty in southern Ethiopia, Doyogena district. The study used 150 households, using a household consumption expenditure approach by employing the FGT (Foster-Greer and Thorbecke, 1984) poverty index to determine the extent of rural poverty. The study's result shows that the total head count index, poverty gap, and poverty severity indexes are 0.438, 0.25, and 0.1452 respectively. Moreover, based on the Binary Logistic regression model output of sample households, there is a significant difference in the poverty level among the poor and non-poor sampled households in terms of factors such as the size of cultivated land, remittances, dependency ratio, participation on off-farm activities, livestock ownership and use of improved seeds were significant up to 10% probability level. Whereas, the age, education, and sex of sampled household heads access to extension service and credit service were not statistically significant. The finding reveals that most of the non-poor households are engaged in more than one livelihood options. On the other hand, income diversification can contribute a certain percentage to help poor households escape rural poverty and Non-agriculture sector should be developed to diversify the income sources of poor households.

Key words: Determinant, extents, rural poverty, binary logistic model.

INTRODUCTION

Ethiopia still ranks among the least developed countries in the world (Ayalneh et al., 2008; United Nations Development Program (UNDP), 2010; 2013; 2014; World Bank, 2009). Ethiopia is home to over 25 million people in absolute poverty. The country is among the world's poorest nations in terms of Human Development Index (HDI). The country's value for 2012 is 0.396, positioning the country at 174 out of 188 countries and

territories compared to 0.475 for Sub-Saharan Africa, (Oxford Poverty and Human Development Initiative (2014); UNDP, 2014).

The Ethiopian Central Statistical Agency (CSA), (2013) assessed the 2012/2013 households consumption, income and expenditure (HICE) Survey results shows the majority of people in Ethiopia are living in rural areas (83%), where poverty is more widespread in rural

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areas than urban area (Dercon and Krishnan, 2000).

In Ethiopia, 87.3 6% of the population lived in multidimensional poverty in urban areas. The proportion of rural Ethiopians who fell below the national poverty line in 2004 and 2005 stood at 39.3% and reduced to 30.4% in 2011. Over the same period, it declined substantially in urban areas, from 35.1% in 2004/05 to 25.7% in 2010/11. In urban Ethiopia, in 2010/11, they observed significant decline in poverty gap and severity, while poverty gap remains the same and poverty severity increased for rural areas.

Experiences in the country showed that the recurrent food insecurity caused from heavy reliance on rain fed agriculture has been quickly turned into famine, which in turn perpetuates the vicious cycle of poverty at household level. The country is frequently hit by disasters. Such disasters are mainly famine and drought, accompanied with climate variability and particularly Ethiopian agriculture, which is extremely sensitive to unpredictable climate variations and high rates of rainfall variability. Here is the center of gravity of Ethiopian poverty. Poverty reduction in Ethiopia requires nothing more than breaking the vicious circle of poverty in the agrarian sector of the economy (CSA, 2012).

The Ethiopian Ministry of Finance and Economic Development (MoFED) examined that, poverty is a serious challenge confronting Ethiopia, the most prevalent and pervasive social problems of the country (MoFED, 2011; 2012). The government clearly acknowledges this in its Strategic Development Plan. Poverty reduction is the core objective of the Ethiopian government. Multidimensional Poverty Index (MPI), which identifies multiple deprivations in the same households in education, health and standard of living for Ethiopia were collected (in the MPI 'head count'); while an additional 6.8 % were vulnerable to multiple deprivations. The intensity of deprivation that is, the average percentage of deprivation experienced by people living in multidimensional poverty in Ethiopia was 64.6%. The country's MPI value adjusted by the intensity of the deprivations was 0.564, which is the share of the population that is multi-dimensionally poor (MoFED, 2013).

In general, the Ethiopian government implements poverty reduction strategy (PRS). Hence, examination of poverty situation at regional, zonal or household levels to identify the specific characteristic of the problem is very important. Having this background, this study tried to assess the level of poverty and its socio-economic and demographic determinants in rural households in *Doyogena District*, southern regional state of Ethiopia.

METHODOLOGY

Data collection and sampling technique

This study used both primary and secondary data. The primary data is collected from a one-year rural household survey conducted in

one rounds in one districts of Ethiopia, during the 2014/2015 cropping Season; consisting of qualitative and quantitative data regarding to Income, Consumption expenditure, social, demographic and economic aspects of farm households in the area, gathered through Semi-structured interview schedule questionnaires.

In addition, focus group discussion and key informants' interviews were carried out to generate all information that is relevant for the study of the rural households' poverty in the study area. The secondary data was obtained from various governmental and non-governmental organizations including Central Statistics Agency (CSA), Ministry of Finance and Economic Development (MOFED), and other related bureaus, FAO, UNDP, WB, IFAD as well as published and unpublished papers and journals.

Three-stage sampling techniques was used in this study to select the required sampling units from the total population under study area, so as to obtain relatively more representative sample from the targeted population. At the first stage, three Local Government Areas was selected randomly. In the second stage three villages was selected from each selected sample Local Government Areas. For the final stage, 17 households from every selected village are randomly selected. Since households in each village are approximately of equal size, the researcher believed that representative sample was obtained to represent the targeted population. Finally, the study covered the sample of 150 households, about 9000 of the total household in the district.

Econometric methodology

Econometric techniques which can be applied to identify the determinants of poverty were applied, to empirically estimate the relationship between the dependent variable and the independent variables. Models that include a yes or no type dependent variable are called dichotomous or dummy variable regression models. Such models approximate the mathematical relationships between explanatory variables and the dependent variable that is always assigned qualitative response variables. In this study, the binary logit model was used to analyze the determinants of poverty in *Doyogena district* (Gujarati, 1995). In addition, The Foster-Greer and Thorbecke, 1984, mathematical model was used to determine poverty indices and employed.

Specification of the binomial logit model

A Logistic model is a univariate binary model. For dependent variable Y_i , there are only two values, one and zero, and a continuous independent variable X_i (Appendix 1), that is:

$$P_r(Y_i=1) = F(x_i' b) \quad (1)$$

Here, b is a parameter which needs to be estimated and F is logistic cdf. Logit model may be preferable due to its lower computation cost, its flexibility, easy computation and wide use in many empirical works as compared to other techniques of such type by Gujarati (1995) and Green (2003). The functional form of cumulative logit model is specified as follows:

$$\text{Prob (event)} = (P_i = E(y = 1|x_i)) = \frac{1}{1+e^{-(\beta_0+\beta_1x_i)}} \quad (2)$$

Where, B_0 and B_1 are coefficients to be estimated from the data; X is the independent variable; e is the base of the natural logarithm for more than one independent variable. The model can be written as:

$$\text{Prob (event)} = (P_i = E(y = 1|x_i)) = \frac{e^z}{1+e^z} \quad (3)$$

$$\text{Equivalently, Prob (no event)} = 1 - P_i = \frac{1}{1+e^z} \quad (4)$$

Where, z is the linear combination of independent variables written as:

$$Z_i = X_i \beta = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n.$$

The probability of an event not occurring is estimated as Prob (no event) = 1 - Prob (event). Equation 3 above represents the cumulative logistic distribution function. If P_i , is the probability of household being poor, given by (2), then $(1 - P_i)$ is the probability of household that are not poor and it can be expressed as:

$$\left(\frac{\text{Prob(event)}}{\text{Prob(no event)}} \right) = e^{X_i \beta} = e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n} = e^{\beta_0} e^{\beta_1 x_1} e^{\beta_n x_n} \quad (5)$$

Equation (5) shows the **odds ratio** in favor of household being poor, the ratio of the probability that a household is poor to the probability that it is not poor. If we take the natural logarithm of equation (5), we will obtain the following equation:

$$L_i = \text{Log} \left(\frac{\text{Prob(event)}}{\text{Prob(no event)}} \right) = X_i \beta = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n \quad (6)$$

That is, L_i is the natural logarithm of the odds ratio. It is not only linear in the explanatory variables, x_i 's, but also (from the estimation point of view) in the parameters. L is called the **logit**, and hence the name logit for models like in equation (6) aforementioned. Now for estimation purpose, by introducing the disturbance term U_i , the logit model can be written as follows:

$$L_i = \text{Log} \left(\frac{\text{Prob(event)}}{\text{Prob(no event)}} \right) = X_i \beta + U_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n + U_i \quad (7)$$

Where, U_i is error term and $U_i \sim N(0, \sigma^2)$, β_0 is an intercept and β_1, β_2 and β_i are slopes coefficients and x is vector of relevant household characteristics. The significance of parameter estimators, β 's, was tested using 'wald test' which is obtained by comparing the maximum likelihood estimate of every β 's with its estimated standard error. By inspecting the sign of dependent variable's coefficient of estimate, the influence of that variable on the probability of a household being poor can be determined.

A positive sign of estimated coefficients would mean that the probability of being poor is higher than reference category and vice versa, keeping all other characteristics constant. In another way, "A number greater than the one of log odds indicates a positive association between independent and dependent variable, while a number between Zero and one indicates negative association among both. Meanwhile, the parameter estimates of the logit model provide only the direction of the effect of independent variables on the dependent variable.

As such, these estimates represent neither the actual magnitude of change nor the probabilities. Differentiating Equation 6 with respect to the covariates provides the marginal effects of the explanatory variables, or the changes in probabilities (slopes) can be computed, though not constant, and are termed as marginal

effects. The marginal effects are given by:

$$\begin{aligned} \frac{\partial E(y/x)}{\partial x} &= \left\{ \frac{d\Lambda(x'\beta)}{d(x'\beta)} \right\} \beta && \text{But,} \\ \frac{d\Lambda(x'\beta)}{d(x'\beta)} &= \frac{e^{x'\beta}}{(1+e^{x'\beta})^2} = \Lambda(x'\beta)[1 - \Lambda(x'\beta)] \\ \text{Thus,} \quad \frac{\partial E(y/x)}{\partial x} &= \Lambda(x'\beta)[1 - \Lambda(x'\beta)] \beta \end{aligned}$$

RESULTS AND DISCUSSION

Setting the poverty line

In order to set the poverty line, the consumption data from the household survey was conducted to reflect the general pattern of food consumption at district level to estimate the quantities of various food items consumed by rural households.

For the study area, defining and selecting a basket of food items that are mostly consumed by the poor in the area is necessary. The average prevailing market prices of those food items considered in the basket was taken. As discussed earlier, there are a number of methods for estimating the total expenditure needed to arrive at the stipulated food energy intake and poverty lines. For this study, cost of basic needs method which was based on the procedure described by Ravallion (1992), Wodon (1997), Ravallion and Bidani (1994), Ravallion (1998) was employed. For the cost of basic needs method, the value of consumption items necessary to meet minimum subsistence needs have to be found.

Food items consumed by reference group households were enumerated and weighted with the appropriate unit of measure (kilograms or liters). Later, the weighted bundles of food items were summed up to get the mean amount of food bundle, a reference group per adult equivalent consumed monthly. The calorie value of each food items was obtained from the World Health Organization (WHO) food nutrition table.

The relevant quantities were converted in to calorie intake to generate the predetermined 2200kcal calorie per day per adult equivalent as the minimum calorie requirement for an adult individual to lead a healthy and active life. Then, the average values were scaled in the same proportion as in the reference food basket. After that, each food items were multiplied after scaling up or down by the mean price per calorie and sum up to get a food poverty line. The nonfood poverty line is estimated by examining the proportion of total expenditure allocated to non-foods, among those households whose total expenditure is approximately equal to sampled households food poverty line (Ravallion, 1998).

Accordingly, the total poverty line for *Doyegena* district is the food poverty line of the sample area. It is found to be Birr 2938.8. The non- food expenditure component is also computed using the average food share of the lowest income quartile households, which is estimated to be 30%. The figure is used to estimate the allowance of the non-food expenditure and found ETB to be 881.64

with the total poverty line of Birr 3820.44. It is the minimum adequate expenditure required to maintain a tolerable life. That means 10.47 Birr per day for each adult.

Indices of household poverty

Having the poverty threshold, estimates of poverty namely head count; poverty gap and squared poverty gap are evaluated in order to assess the present status, depth and severity of poverty in the study area. Incidence, depth and severity of poverty among the rural sample households following the FGT index has been made here below. As it has been discussed before for this study, absolute food poverty line of ETB 3820.44 expenditure for each adult per annum is employed, using 2200kcal daily per adult as the minimum calorie requirement for an adult individual to lead a healthy and active life. Sample households whose expenditure for every adult per annum is greater than and equal to ETB 3820.44. They are deemed to be non-poor, otherwise poor.

Head count index ($\alpha=0$)

As discussed earlier, it is the share of sample households whose basic needs expenditure per adult equivalent is below the poverty line. That is, the share of households that cannot afford to buy the basic basket of items. In the result of the estimation, it is indicated that the poverty incidence in the study area is 43 % at the absolute poverty line, that is, ETB 3820.44. This proportion implies of the percentage of the sampled population who is unable to meet the required minimum amount of calorie for each person per day. In other words, this proportion of households does not fulfill the minimum amount of income (ETB 3820.44) to satisfy the minimum calorie requirement per adult equivalent/ day.

Poverty gap index ($\alpha=1$)

This index provides information on how much poor household's mean aggregate consumption shortfall relative to the poverty line across the sample. It is the difference between per capita expenditures and poverty line and then divided by the poverty line.

It is, therefore, a much more powerful measure than the head count ratio because it takes into account the distribution of the poor below the poverty line. That is, it reflects the per capita cost of eliminating, poverty assuming perfect targeting of resources. The figure tells us that the percentage of total consumption needs to bring the entire population to above the poverty line or the minimum level of living.

The result shows that overall poverty depth at the absolute poverty line ETB 3820.44 per adult per annum is

found to be 0.2325; meaning the rural Doyogena district should mobilize resources equal to about 23.25 percent of the poverty line and distribute it to every individual in the amount needed so as to bridge the expenditure gap under the assumption of perfect targeting. In other words, the expenditure gap or the average of total consumption needed to bring the entire poor households at least at this poverty line is 23.25 % of poverty line.

Poverty severity index ($\alpha=2$)

It takes into account not only the distance separating the poor from poverty line, but also inequality among the poor. Thus, higher weight is placed on households further away from the poverty line. At the absolute poverty line, that is ETB 3820.44 per adult yearly, the result indicates that poverty severity index is 0.1452. This means that there is about 14.52 % of relative deprivation among poor households in the study area.

Determinants of poverty

So far, households are characterized based on different demographic and socio economic factors, to measure the extent and severity of poverty.

In addition to the basic descriptive statistics, the logistic regression model was employed to identify the determinants of household. From the analysis of this binary logit model (Appendix 2), thirteen explanatory variables are included, of which seven variables are found to be significant determinant factors of household poverty in study area.

Therefore, agricultural remittance, off farm income, livestock ownership, total land size holding, dependency ratio, family size and age dependency ratio are found to be significant influence on household poverty status. The rest seven out of the explanatory variables were found to have no significant influence on poverty status of the households (Appendix 1).

Age dependency ratio ($dpndcyr$)

It is found to be a significant factor directly affecting poverty status of households in the study area at less than 1% significance level. This means that the probability of household being poor will increase with an increase in the number of age dependents. The marginal effect is 0.3196114. This implies that keeping all other variables constant, as the age dependency ratio of households' increases by one more unit, the probability of being poor increases by 31.96%.

Livestock (tlu)

Livestock owned by the household measured in Tropical

livestock unit (TLU) is expected to reduce the chance of being poor. In line with this expectation, the survey result showed a negative relation between total household owned livestock and poverty, and the coefficient is highly significant at less than 5% significance level. The marginal effect, 0.184796, indicates that as the total tropical livestock holding increases by one more unit, the probability of being non-poor increases by 18.48% and other things remain constant.

Land size (landsz)

It is statistically significant to determine the household's poverty status at less than 10 % significance level with negative sign. That is, household who own larger farm land size is more likely to be non-poor than those with relatively smaller farm land size. The marginal effect is -0.4733348. That is, as the total land size holding increases by one more hectares, the probability of being non poor increases by 47.33%, while other things remain constant

Access to nonfarm (offarm)

In line with a prior expectation, the variable nonfarm activities are significant at less than 5 % with negative sign. That is, the more the household has opportunity of participating in off farm income generating activities, the more they will live above poverty. More specifically, the marginal effect was found to be -0.2220652, The probability that a household being non poor increase by about 22.21%, if the household has access to farm activity; holding all other things constant.

Remittance (remit)

This is another variable that most significantly affects rural poverty *in the study area*. It is significant at less than 1% level of significance and negatively related with household poverty. The result is in line with a prior expectation. The marginal effect -0.445779 indicates that as remittance increases by one more unity, the probability of being poor decreases by nearly 44.6%; other things remain constant.

Use of high yield variety seeds (impseed)

In line with prior expectation, this variable is also significant at less than 5% level of significance and inversely related probability of being poor. Those farmers who use HYV seeds get more yields per hectare and more income which lifted them above poverty line. The marginal effect corresponding to the improved seed is –

0.144017, implying that as the Use of High yield variety seeds increases by one, the more the probability of not being poor increases by 13.41 %; assuming other things are held constant.

Household family size (hhsiz)

It is found to be a significant factor directly affecting poverty status of households in the study area at less than 10% significance level. This means that, the probability of household being poor will increase with an increase in the number of family size at an adult equivalent. The marginal effect is .0990523, implying that keeping all other variables are constant. As the number of family size of household increase by one more unit, the probability of being poor increase by 9.91%.

However, the coefficients household family size, age of the household, sex of the household, household access to rural credit, household access to extension service and household participation on safe net program are not significant. This is due to the fact that in the study area, both the poor and non-poor household heads exhibited high level of illiteracy and households' educational status. This shows that, 66% of respondents are illiterate.

Regarding the age of the household, as young farmers they tend to be less risk-averse and are more willing to try new technologies, this may lead to better income. On the other hand, the age of household head increases his or her experience about farm resource and risk management increases, family member migrate and send remittance increase and age dependency decrease as well.

In the study area, most of the households who get the chance to participate in the safety net program for long period of time are still in chronic poverty. This shows the effect safety net program in lifting a significant number of households out of their chronic poverty is very low. On the other hand, about 107(70%) of the total respondents have not the chance to take loans. Besides, most of the households who got credit are from private with high interest rate, and most of them receive at the time of maskel holidays.

Conclusion

This study has studied the extent and the determinants of poverty in Doyogena districts in rural areas of southern Ethiopia. The methodology used in this study emphasised on the analysis of relevant variables that make household to be poor based on the household survey undertaken on 150 sample households. Econometric methods, mainly logit model were used to identify key covariates of poverty that are strong correlates with consumption based household's welfare.

In order to show the level and magnitude of poverty,

cost of basic goods and FGT index was applied. Accordingly, food expenditure per adult equivalent of households was compared against the absolute food poverty line in order to classify households in the study area into poor or non-poor. Hence, among the studied households 43.33% of the household in district are found to be poor. The total poverty line for the study area was 10.47 Birr per day per adult equivalent. The poverty head count is 43% and the poverty gap in the study area is 23.25% of the poverty line which means the average total consumption needed to bring the entire poor households at least at this poverty line is 23.25% of poverty line. The estimate of the severity of poverty among the rural poor was 14.52% this implies there is 14.52 percent of relative material deprivation among poor households. It shows that household poverty is pervasive in rural district of Doyogena.

The result of binomial logistic model regarding the main determinants of household poverty in the study area, revealed that out of 13 independent variables included in the model, 7 of the explanatory variables were found to be significant up to less than 10% probability level. Hence, number of livestock in tropical livestock unit, participation on off farm income activities, and age use of improved seeds, total land size holding, family size and access remittance income are found to be significant determinants of households' poverty and all of them are inversely related to it. Whereas, age dependency ratio, is significantly and positively correlated to households' poverty. On the other hand, the results showed that the probability of a household being poor increased due to its dependency ratio. The chance of being poor decreased with a greater number of livestock in tropical livestock unit, participation on off farm income activities, total land size holding, access remittance income and use of improved seeds.

The study finding shows that in the study area, agriculture and remittances continues to play a dominant role in the livelihoods of rural households, source of income. Agriculture is fully relying on rain and the study area is the only district in the zone that has no irrigation access for cultivation. The problem of smaller landholding size is associated with large family size and the growth of population causing the shortage and scarcity of cultivable land. This makes more pressure on scarce land and it in return aggravate youth immigration from the area and the gradual loss of land productivity particularly depletion of soil fertility and hence the low yield and low productivity of agricultural production increase the problem of household poverty. The main causes for the loss of soil fertility are over cultivation and overgrazing of agricultural lands.

Moreover, the lack of farmland management practices is the main reasons for low production. In the study, district reasonable number of households in the study area have income from remittances and there is a big different of well-being among migrant sending and non-

migrant sending households especially to South Africa.

POLICY IMPLICATION

Poverty is a complex and multi-dimensional phenomena. As a result, finding solutions to reduce poverty extent of a given study area is not a simple issue. This study tried to explore the covariates of rural poverty using a sample of 150 representative households taken from the three rural kebeles of the district. At least from a consumption expenditure poverty perspective, the determinants of poverty in *Doyogena* district are those presented in the previous parts. Hence, on the basis of the aforementioned findings the following recommendations can be forwarded.

The survey result has found that the majority of poor households with large family size accompanied by large dependency ratio were poor. This calls for improving family planning and strengthening of Health Extension Package program in the area. Thus, in addition to home to home awareness creations on family planning, public discussions about how to use contraceptive methods need to be implemented in more organized manner than before. Efforts at further sensitizing the populace on the need to control birth and to remove all cultural beliefs that tend to lead to overpopulation should be encouraged through proper advocacy. In addition to this, the beneficial effects on women's health, labor force participation, and productivity could also help reduce dependency ratio and in return poverty.

Sizes of livestock including oxen owned by the household highly determine poverty condition in the study area. Livestock contributes to the study *kebeles* in several ways such as serving as a source of food, manure, income; provide means of transportation, traction power, as asset and a security against crop failure. They help to plough fields and provide means of transportation. So in order to increase their benefit for the poor technical advice and training in animal ranching should be offered to make them above poverty line.

Since land size in the district is very small and agriculture activity is mainly rain fed and water supply is very poor. Lack of water sources to access irrigation services causes the district to depend on rain-fed agriculture. So efforts should be done to use ground water to enhance agricultural production and productivity twice a year at this small cultivating land size, that would enhance poverty reduction in the area.

According to the study finding, most poor households did not have access to credit and improved agricultural inputs, which has great contribution for the households to graduate from poverty. It is recommended that a credit availability and accessibility should be expanded for rural households, and its provision mechanism should focus the poor which helps them to purchase agricultural inputs and participate on nonfarm activities. Introducing high

yielding improved crop varieties, improving method of cultivation, promoting small scale irrigation by ground water and improving the livestock production should be taken into consideration by concerned government administrations and agricultural office.

The study finding reveals that most of non-poor households are engaged in more than one livelihood options. As it is known, income diversification can contribute a certain percentage of poor households to escape from extern poverty. Non agriculture sector should be developed to diversify the income sources of poor households, because the finding highlights the fact that income and employment of agriculture growth were insufficient to lead to households consumption and substantial gains in rural households, insufficient to reduce the level o rural poverty. Increasing off-farm activities such as petty trade, handicrafts and the like are used to diversify the sources of income and increase household consumption availability.

Furthermore, the study shows that it is important to differentiate incident severity *among* poor, so attention needs to be paid to the poorest of the poor and the poorest of the poor need to be identified and specifically supported.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Appendix 1. Variables and their descriptions.

S/N	Variable	Code	Type	Description
1	Number of family size	FMSZ	Continuous	Total number of family size
2	Age household head	AGE	Continuous	Age of the HH head from birth in years
3	Size of cultivated land	LDSIZ	Continuous	Total land cultivated in hectare per household
4	Dependence ratio	DERIO	Continuous	Age dependency ratio per household
5	Total livestock (cattle, sheep, goats) holding	TLIVS	Continuous	Total number of livestock owned per household
6	Sex of household head	SEX	Dummy	1 if the household head is male, 0 otherwise
7	Educational level of the household head	EDUC	Dummy	1 if the household head is literate, 0 otherwise
8	household's Access to off farm Income	EMPT	Dummy	1 if household has access to off-farm activities, 0 otherwise
9	Distance to the market	DTMK	Dummy	1 if , 0 otherwise is near to market center, 0 otherwise
10	Household use of high yielding variety of seeds	HYVS	Dummy	1 if household uses high yielding variety of seeds, 0 otherwise
11	Remittances(migrant from household)	RMTC	Dummy	1 if household gets Remittances from migrants of HH members , 0 otherwise
12	Agricultural extension service	EXSER	Dummy	1 if household gets agriculture extension service, 0 otherwise
13	Access to <i>micro</i> credit service	CRDASC	Dummy	1 if the household get credit access ,0 otherwise
14	Productive Safety Net Participation	PSNPP	Dummy	1 if the household participates in safety net program , 0 otherwise

Appendix 2. Maximum likelihood estimates of the binary logit model.

pstat	Coef	Std. Err	P-value	Marginal effect (dy/dx)
hhage	-.0422033	0.0419407	0.314	0.037115
hhsex	-1.259556	1.257218	0.316	-0.158964
hhedu	.036825	1.117089	0.974	0.003254
hhsz	.3303485*	.2616766	0.0807	0.0990523
dpndcyr	3.634247***	1.089318	0.001	0.3196114
tlu	-0.9642007**	0.4153278	0.020	-0.184796
remitt	-2.364291***	.8778808	0.000	-0.445779
offarm	-3.73856**	1.665476	0.025	-0.2220652
extnsn	.2874776	0.07016	0.755	0.0238912
safetynt	-2.635951	1.777174	0.138	-.1089941
impseed	-2.193902*	0.08314	0.055	-.144017
credit	-.9984176	0.90096	0.268	-0.0875557
landsz	-5.382209**	2.44835	0.028	-0.4733348
cons	.1049648	3.36662	0.975	-

Source: Own Survey Data, 2015; Number of Observations =150; LRchi2(13)=145.52; Log pseudo Likelihood =-25.504724; Prob > chi2 = 0.000; Count R2 = 73.85%; Sensitivity- correctly predicted poor group 92.19%; Specificity- correctly predicted non-poor 95.00%.

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