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Determinants of Multidimensional Poverty Among Rural Households in Northern Ethiopia

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Abstract

The study was aimed at investigating the socioeconomic correlates of households' multidimensional poverty in northern Ethiopia, focusing on the Degua Tembien District of Tigray. Cross-sectional data, gathered using a household survey of 420 randomly selected households, were used to realize the objective of the study. The multidimensional poor and non-poor households were identified using the Alkire-Foster method of multidimensional poverty, and determinants of poverty were investigated using logistic regression models. Findings show that 60 percent of households are multidimensionally poor. Households' multidimensional poverty is significantly and negatively associated with contact with extension agents, education level of the household head, household size, number of plots, household's annual income, and access to hired non-household labor. Human capital development, introducing a wide range of extension services, increasing agricultural productivity through intensification, effective utilization of local reciprocal labor engagements, and improving income through diversifying livelihood activities is recommended to reduce the high multidimensional poverty in the study district.

Keywords: multidimensional poverty, deprivation, Alkire and Foster, determinants, households

1.0 Introduction

For decades, income distribution statistics were used to assess and analyze poverty (Sen, 1976). However, recently it has been recognized that both monetary and non-monetary components are crucial to understand and measure an individual's and household's poverty level (Bourguignon & Chakravarty, 2003). Reducing poverty has become the major development objective for governments around the world. The 2015 Sustainable Development Goal 1 calls to "end poverty in all its forms everywhere," by the year 2030 (UN General Assembly, 2015, p. 15). It indicates

that poverty is increasingly recognized as a multidimensional concept which fundamentally requires a comprehensive approach to design anti-poverty policies, strategies, and programs.

Poverty in Ethiopia is a major development problem that has given rise to many socioeconomic problems that threaten the survival and stability of the society. As a result, poverty reduction has become the top development agenda of the country, and the government has designed and implemented numerous policies, strategies and programs including Growth and Transformational Plan I and II, which cover the periods 2010/11 to 2014/15 and 2015/16 to 2019/20, respectively (Ministry of Finance and Economic Development [MoFED], 2010; MoFED, 2016). These efforts of the government aimed at reducing poverty and improving the living standard of the people, which will bring about sustainable national development. Despite such efforts, several studies indicated that poverty in Ethiopia remains high (Brown & Amdissa, 2007; Gelaw, 2010; United Nations Development Programme [UNDP, 2015]; Alkire & Kanagaratnam, 2018). The recent poverty assessment also shows that with about 109 million people in 2018, Ethiopia is among the poorest countries in the world with a per capita income of US$790 (The World Bank, 2019). The Human Development Index of Ethiopia in 2017 was 0.463, which put Ethiopia in the low human development class in the world (UNDP, 2018).

The development of multidimensional poverty theory leads to the consensus that poverty is not unidimensional. Alkire and Foster (2007; 2011) developed a new tool of poverty measurement in 2007, which allows the measurement of multidimensional poverty using the concepts of the capability approach. This recent development has increased the focus of poverty research from a monetary approach to the multifaceted theory of poverty. Measured by multidimensional poverty indicators, the Oxford Poverty and Human Development Initiative [OPHI] (2018) reported that Ethiopia's Multidimensional Poverty Index (MPI) was 49%, while the incidence and intensity of multidimensional poverty was 84% and 59% in 2016, respectively. This approach also puts Ethiopia among the poorest countries in the world. Sen (2009) strongly argues that a lack of income cannot fully explain poverty and does not guarantee that somebody will achieve the minimum of its needs. Although Von Maltzahn and Durrheim (2008) highlighted that having a higher income and consumption enables individuals to enhance their socioeconomic wellbeing and capabilities, Thorbecke (2005) noted that there are some non-monetary problems such as access to electricity, education and health care services, which cannot be obtained in the market due to market imperfections. Thus, income or consumption expenditure is important but not a sufficient measure of poverty.

In understanding the issues of poverty in Ethiopia, various studies have been conducted. However, as observed in many studies (Hagos & Holden, 2003; Bogale, Hagedorn, & Korf, 2005; Alemu, Bewket, Zeleke, Assefa & Trutmann, 2011; Bogale, 2011; Afera, 2015; Mekore &Yaekob, 2018; Biyena & Beyene, 2019), analysis and discussions were mainly focused on the extent and determinants of poverty using a unidimensional approach. Few studies such as Brück & Kebede (2013), Gerezgiher (2016), Bersisa & Heshmati (2016), and Tigre (2018) conceptualized poverty as multidimensional and assessed determinants of multidimensional poverty in Ethiopia using the Alkire-Foster methodology. Despite various economic potentials, household multidimensional poverty in Ethiopia remains high and unacceptable. Hence, understanding the local-level causes of poverty in the sense of determinants is important to address the complicated problem

of rural poverty and provides information to policy-makers as context-specific efficient poverty reduction interventions require proper identification of factors that are strongly associated with poverty. Apart from the global multidimensional poverty indicators, this study incorporates locally important indicators such as land and livestock ownership, cooperative membership, and decision making on income, which are not considered by previous studies. Therefore, this study is aimed at documenting the determinants of multidimensional poverty among rural households in Degua Tembien District, Northern Ethiopia. In light of this, the study seeks to answer two essential questions: (1) what are the major determinant factors of households' multidimensional poverty in the study District?; and (2) which indicators have the decisive marginal effect as determinants of multidimensional poverty?

The following sections of this paper are organized as follows. Section 2 presents a brief description of the methods of the study. Section 3 discusses the empirical results of the study, while section 4 presents some concluding remarks and implications.

2.0Methods

2.1 The Study Area in Northern Ethiopia

The empirical setting for this particular study is Degu'a Tembien District, one of the four Southeastern Zonal administrations of Tigray in Northern Ethiopia. The District is geographically found is located between 39º10' East Longitude and 13º38' North Latitude (Admasu, Kiros & Memhur, 2011), at an elevation of between 1500 to 2750 metres above sea level (Degua Tembien Woreda Office Planning & Finance [DTWOPF], 2017). The capital of the District, Hagereselam, is located 50km from Mekelle, the regional capital (Admasu et al., 2011). The District has three agro-ecologies, namely highland, temperate, and lowland, with a share of 43.75%, 37.5%, and 18.75% of the District area, respectively. The annual amount of rainfall ranges from 600–800 mm, while the annual average temperature of the District ranges from 8ºC to 24ºC (DTWOPF, 2017).

The major soil types of the District are mainly clay (50%), sandy loam (40%), and sandy (10%) (Nyssen, Vandenreyken, Poesen, Moeyersons, Deckers, Mitiku, Salles, & Govers, 2005). As the dominant source of livelihood for most of the population, agriculture is small-scale in its nature and is composed of mixed crop-livestock farming. The major crops grown and cultivated in the District include cereals like barley, wheat, and teff. Cattle, sheep, goats, donkeys, and mules are the major livestock reared by households in the study area (Nyssen, Naudts, Geyndt, Mitiku, Poesen, Moeryersons, & Deckers, 2008). However, the District is one of the most poverty-stricken and drought-prone areas in the region and is distinguished by a high prevalence of food shortage.

2.2 Sampling and Data Source

A multi-stage sampling design was used to select sample respondents from the study area. First, the study kebeles was stratified into three agro-ecologies, namely, highland, midland, and lowland. Second, two study kebeles (lowest administrative unit) were taken randomly from each stratum. Finally, after taking the household baseline data from the District's Agricultural Bureau, the sample size of the study was determined using Yamane's (1967) simplified formula [i.e, $n=N/1+N(e^2)$, where

n is the sample size, N denotes the population size, and e refers to precision level]. By applying the proportional sampling method to the size of the kebele population, a sample of 420 rural households was selected using a simple random sampling technique. A household survey questionnaire was administered among the sample households to collect information related to socioeconomic characteristics and a set of multidimensional poverty indicators linked to the characteristics of the study area.

2.3 Analytical Techniques

2.3.1. Multidimensional Poverty Indicators. This study identified five poverty dimensions comprised of 13 indicators along with their deprivation cutoff points. As indicated in Table 1, the five dimensions of multidimensional poverty are education, health, living standard, wealth, and empowerment. Education poverty is captured by years of schooling and school enrolment. A household was considered deprived in respect to years of schooling if no household member had completed five years of schooling, while a household with at least one school-aged child (6 to 14) not enrolled in school was considered deprived in respect to school enrolment. Health care access, health status (functioning) and child mortality measure the health dimension of poverty. A household was considered as deprived in respect to health care access if it did not have access to health care facilities in the village. A household was considered as deprived in respect to health functioning if health becomes a limiting factor for any member of the household to pursue regular household activities due to sickness in the last three months. A household was considered as deprived in respect to child mortality if one child had died in the household during the past five years.

Four indicators, (1) access to safe drinking water, (2) access to improved sanitation, (3) energy for cooking, and (4) access to electricity, measure the standard of living aspect of multidimensional poverty. A household was considered deprived in respect to water access if it had been using unimproved (such as unprotected spring and surface water) water sources; deprived in respect to sanitation if it used a unimproved sanitation facility; deprived in respect to electricity if it had no electricity connection; and considered deprived in respect to cooking fuel if it used animal manure, charcoal, and/or wood. The wealth status of households was captured by the size of land it was using/cultivating and livestock ownership in Tropical Livestock Units (TLU). A household was identified deprived in land if it owned (used) less than 0.66 hectares of land (i.e., local average), while TLU ownership below the local average (i.e., 4 TLUs) was considered as deprived in livestock ownership. Finally, the empowerment dimension of poverty was measured by the household's decision-making on income and cooperative membership. A household was identified deprived in respect to cooperative membership if it did not have any household member that was part of any cooperative society. A household was considered deprived in regard to decision making if all members of the household, particularly both the husband and wife, did neither participate nor make decisions on the use of income.

Table 1.*Wellbeing dimensions, Indicators and Deprivation Cutoff Values*

Wellbeing Dimensions(Weight)	**Deprivation Indicators(Weight)**	**Deprivation Cutoffs**
Education (1/5)	Years of schooling (1/10)	1= if no household member has completed five years of schooling; and 0 otherwise
	Child school enrollment (1/10)	1= if any school-aged child* in the household is not attending school; and 0 otherwise
Health (1/5)	Health care access (1/15)	1= if a household does not have access to health care services in their village and 0 otherwise
	Health functioning (1/15)	1= if any member is unable to pursue main household activities due to serious disease for at least three months; and 0 otherwise
	Child mortality (1/15)	1= if any child had died in the household in the past five years prior to this survey; and 0 otherwise
Standard of Living (1/5)	Access to safe drinking water(1/20)	1= if the household uses unimproved drinking water sources** ; and 0 otherwise
	Access to improved sanitation (1/20)	1= if the household's sanitation facility is not improved** ; and 0 otherwise
	Energy for cooking (1/20)	1= if the household cooks with dung, wood, or charcoal; and 0 otherwise
	Electricity (1/20)	1= if the household has no electricity; and 0 otherwise

Wellbeing Dimensions(Weight)	**Deprivation Indicators(Weight)**	**Deprivation Cutoffs**
Wealth (1/5)	Land ownership (1/10)	1 = if the household does not own (use) more than local average (i.e., 0.66 ha. of land); and 0 otherwise
	Livestock ownership in Tropical Livestock Unit (TLU) (1/10)	1 = if the household does not own TLU more than local average (4); and 0 otherwise
Empowerment (1/5)	Decision making (1/10)	1 = if household decision-making on the use of income is not participatory; and 0 otherwise
	Cooperative membership (1/10)	1= if no member of the household is a member of cooperatives; and 0 otherwise

*According to Ministry of Education [MOE] (2009), the compulsory school age for children in Ethiopia is 6-14 years.

**According to WHO and UNICEF (2006) and WHO (2014), improved water sources include piped water close to plot or yard, protected springs, bottled water, hand pumps, public standpipes, protected wells, and piped water into dwelling. Unimproved water sources include unprotected wells, carts with small tanks, unprotected springs, tankers, and surface water. The WHO and UNICEF (2006) and WHO (2014) guideline for improved sanitation facilities includes flush to piped sewer system, flush to pit, bucket, pit latrine, and composting toilet. Unimproved sanitation facilities include open defecation or bush/field.

The recently developed Sustainable Development Goals (UN General Assembly, 2015) have provided strong grounds for the incorporation of the multidimensional poverty indicators. Following Alkire and Santos (2010), equal weighting was adopted to compute the household's multidimensional deprivation score. According to Chowdhury and Squire (2006), equal weighting was adopted in the Human Development Index (HDI) convention. Thus, the weight assigned to each dimension is 1/5, and each indicator within a dimension is also equally weighted.

2.3.2. The Study Model. The censored deprivation score, which reflects household's joint deprivation is used to compute the multidimensional deprivation score of households and this score was classified into two groups to determine the multidimensional poor and non-poor households (Alkire, Foster, Seth, Santos, Roche, & Ballon, 2015). All households are assigned a deprivation score in all selected multidimensional poverty indicators. A deprivation status score of 1 is assigned if the household is deprived in any indicator, and a status score of 0 is given otherwise. This process is called censoring the deprivation score of households (Alkire et al., 2015). Following Alkire and Santos (2015), the weighted deprivation score (c_i) for each household was calculated following this simplified equation:

$C_i=W_1I_1+W_2I_2+W_3I_3+W_4I_4+W_5I_5+W_6I_6+W_7I_7+W_8I_8+W_9I_9+W_{10}I_{10}+W_{11}I_{11}+W_{12}I_{12}+W_{13}I_{13}$…… (1)

Where W is the weight attached to each indicator, and I represents the score for each indicator of all dimensions.

According to Alkire and Foster (2007; 2011), if the deprivation score c_i, of a household computed using equation 1 is equal to or greater than the multidimensional poverty cutoff (k)—i.e., 33.33% of the weighted indicators—the household is considered multidimensionally poor. This is expressed by a binary variable (y_i) that takes the value of 1 if the household is identified as multidimensionally poor and 0 otherwise, as follows:

$$y_i= \begin{cases} 1 \text{ if the household is multidimensional poor } (ci \geq k) \\ 0 \quad \text{otherwise} \end{cases} \quad \ldots\ldots\ldots\ldots(2)$$

Therefore, after categorizing households as multidimensionally poor and non-poor using y_i, binary logistic regression was employed to identify the major determinant factors of poverty in the study District. Gujarati (2004) noted that there exists hardly any difference between logit and probit models since they provide similar inferences. However, logistic regression is preferred due to its comparative mathematical simplicity and easy interpretability. Following Gujarati (2004), the cumulative (logistic) distribution function is given as:

$$P_i=E(Y=1|X_i) = \frac{1}{1+e^{-(\alpha \; + ßiXi)}} \ldots\ldots\ldots\ldots 3$$

Where P_i is the probability that household i is multidimensional poor given X_i; X_i are the i[th] explanatory variables; e is the base of natural logarithms; α is constant of the logistic regression equation; $ß_i$ are unknown regression coefficients interpreted as marginal changes of the logit due to a one unit change in X_i . For simplicity, we can write equation 3 as:

$$pi = \frac{1}{1+e^{-zi}}, \text{ where } Z_i= \alpha \; +ß_i X_i \ldots\ldots\ldots\ldots 4$$

The probability that a given household is multidimensional non-poor is given as

$$1\text{-}pi= \frac{1}{1+e^{zi}} \ldots\ldots\ldots\ldots 5$$

Therefore, the odds ratio in favor of being multidimensional non-poor is given as

$$\frac{pi}{1-pi} = e^{zi} \ldots\ldots\ldots\ldots 6$$

Taking the natural logarithm, equation 6 can be rewritten as

$$Li = ln\left(\frac{pi}{1-pi}\right) = \; Zi = \alpha + \sum_{i=1}^{n} ßiXi + \mu i \ldots\ldots\ldots\ldots 7$$

Where, Li is the logarithm of the odd ratio, which is assumed linear for both variables and parameters; Zi is a function of independent variables; pi is the probability of being multidimensional poor; $1–pi$ is the probability of being multidimensional non-poor; and μi denotes the disturbance term. Therefore, the probability of households

being multidimensional non-poor depends on a set of indicators denoted as *X*. Finally, marginal effects after the logit model were estimated to measure the change in the probability of Y_i=1 as a result of a unit change in a particular independent variable. Variables included in the estimation were selected considering previous studies on poverty determinants in developing countries, including Ethiopia, and described in Table 2 as follows.

Table 2: *Construction of variables used in the regression model*

Variables	**Type and Description**	**Measurements**
Dependent variable		
Multidimensional poverty status	Dummy, multidimensional deprivation status households' experiences. The value of the adjusted headcount ratio (MPI) for a poverty cutoff k ≥ 33.33% of the weighted indicators (i.e., k=4) was taken as the poverty threshold to categorize households as poor or non-poor	1 if households are multidimensional poor (i.e., the deprivation score is ≥ 33.33), 0 otherwise
Independent variables		
Household head education	Continuous, level of schooling a household head attained	Years
Household head age	Continuous, household heads age at the time of interview	Years
Household size	Continuous, number of individuals living in the household and share common kitchen	Number
Dependency ratio	Continuous, number of dependents in a household (aged between 0 to 14, and aged 65 and older) divided by the number of working-age groups (15 to 64)	Ratio
Number of plots	Continuous, number of agricultural fields (farmlands)	Number
Households annual income	Continuous, annual income obtained from farm and non-farm activities	Birr

Table 2 continued

Participation in off-farm employment	Dummy, household engagement in off-farm activities	1 if yes, 0 otherwise
Contact with extension agents	Dummy, contact with employed agricultural extension advisor	1 if had contact, 0 otherwise
Credit access	Dummy, households credit access	1 if yes, 0 otherwise
Training	Dummy, households vocational training	1 if trained, otherwise
Non-household labor	Dummy, access to non-household labor supply	1 if has access, 0 otherwise

3.0 Results and Discussion

3.1 Description of Households Multidimensional Poverty Status

As can be seen in Table 3, findings revealed that a higher proportion of households (60%) were classified as multidimensional poor, while 40% of households were found to be multidimensional non-poor. This shows that the greater proportion of surveyed households is suffering from acute multidimensional poverty as they are deprived of basic and multiple human services and facilities. Households suffer multiple deprivations in education, health, living standard, wealth, and empowerment dimensions of wellbeing. Such severe deprivation in these dimensions led to functioning failure and low quality of life, which in turn leads to higher incidence and intensity of multidimensional deprivation of poor households. Although prior studies on multidimensional poverty in the study District are not found, this finding is largely higher than the official monetary poverty report of Ethiopia, which is 23.5% in 2015/16 (Planning and Development Commission, 2018).

Table 3:*Percentage Distribution of Households by Multidimensional Poverty Status (at k=4)*

Households Poverty Status	**Frequency**	**Percent**
Multidimensionally poor	253	60
Multidimensionally non-poor	167	40
Total	420	100

3.2 Logistic Regression Diagnostic Tests

Before presenting logistic regression results and drawing conclusions, it is important to verify the data meet the basic assumptions of the model, otherwise results may be misleading. Bewick, Cheek, & Ball, (2005) indicated that low correlation among the independent variables is required before running the model. Hence, different multicollinearity diagnostic tests were performed to check the level of collinearity between each explanatory variable for both continuous and dummy variables. As a rule of thumb, for continuous variables, Chatterjee and Hadi (2012) indicated that, if any of the Variance Inflation Factors (VIFs) exceed 10, the regression coefficients are poorly predicted due to high multicollinearity. Based on this rule, the result of the diagnostic test shows low collinearity between explanatory variables with 1.11 mean VIF. The coefficient of contingency was used to check collinearity among the discrete variables. According to Healy (1984), a contingent coefficient with a value of 0.75 and above indicates high collinearity. Hence, the result shows that none of the variables' correlation between any two explanatory variables exceeded 0.1, implying that dependencies or the extent of the relationships between explanatory variables are not a serious problem in our analysis.

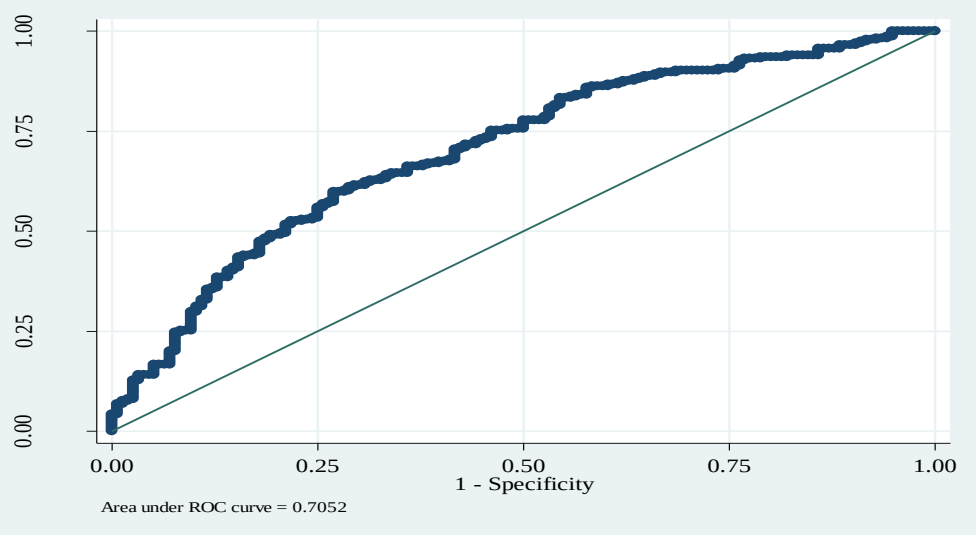
Archer and Lemeshow (2006, p. 97) stated that "once a logistic regression model has been fitted to a given set of data, the adequacy of the model is examined by overall goodness-of-fit tests, area under the receiver operating characteristic curve, and examination of influential observations." Therefore, specification errors tests and goodness-of-fit tests were diagnosed. The link test was conducted after the logistic regression to detect a specification error. This test regress the independent variable on its predicted value (_hat) and the predicted value squared (_hatsq). The outcome of the link test (specification errors test) in Table 4 indicates that the model equations were properly specified as predicted by the hat-statistic (_hat) as the p-value is 0.000. The variable _hat should be a statistically significant predictor unless the model is completely miss-specified. On the other hand, if the model is properly specified, the prediction squared (_hatsq) should be insignificant. Therefore, our link test result shows no problem with the specification.

Table 4: *Link Test Output of the Regression Model*

MD Poverty Status	**Coef.**	**Std. Err.**	**Z**	**P > |Z|**	**[95% Conf. Interval]**	
_hat	1.017002	.2021478	5.03	0.000	.6207993	1.413204
_hatsq	-.0204152	.1504731	-0.14	0.892	-.315337	.2745066
_cons	.0065256	.1323161	0.05	0.961	-.2528092	.2658604
Number of obs =390		LR chi2(2) = 48.82Log likelihood = -238.06495				
Prob> chi2 =0.0000		Pseudo R2 =0.0930				

The Receiver Operating Characteristic (ROC) curve was also used to validate the assumptions of the model specification (tests for predictive accuracy). As indicated in StataCorp (2013), the graph of the ROC curve is a graph of sensitivity (the ability of the model to predict an event correctly) versus one minus specificity as the possible cutoff is increased from 0 to 1. Sensitivity refers to the fraction of observed positive-outcome cases that were correctly classified, while specificity is the fraction of observed negative/false-positive cases that are correctly classified. The greater the predictive power, the more bowed the curve, and hence the area under the ROC curve is used to measure the predictive power or accuracy of the diagnostic test. A model with no or worthless predictive power has an area of 0.5, while a ROC area with 1 represents a perfect model. Therefore, Figure 1 below shows that the model has acceptable predictive power as the area under the curve is 0.7052 (Hosmer & Lemeshow, 2000).

Figure 1. Receiver Operating Characteristic Curve of the Model.



Source: Authors.

Another important test of model fit used was the Hosmer and Lemeshow's goodness-of-fit test, which answers the question of how good the existing data fits the model. The Hosmer and Lemeshow's goodness-of-fit test requires a large p-value (insignificant) to prove a good fit model. Hence, the result of the test shows that with a p-value of 0.68, the model was correctly specified and fitted the data adequately. Overall, it is concluded that all diagnostic tests confirmed that the logistic regression model is adequate and fits the observed data well.

3.3 Determinants of Multidimensional Poverty

Examining the incidence of poverty using a multidimensional measure provides essential evidence on the scope or extent of multidimensional poverty in the study District. However, it does not point out the most important factors that affect the multidimensional poverty status of the household. The logistic regression output presented in Table 4 provides the determinants of multidimensional poverty and the marginal effects of each explanatory variable. Looking at the model statistic, the model, as a whole, is statistically significant at the one percent level of significance ($p<0.0000$).Of all hypothesized independent variables, household head education,

household size, contact with extension agents, number of plots, access to hired non-household labor, and annual income are found to be significant determinants of a household's multidimensional poverty.

Table 4.*Logistic Regression Results of Determinants of Multidimensional Poverty*

Variables	**Coefficients**	**Marginal Effects**
Household head education	-0.080(.037)**	-.019(.009)**
Household head age	-.018(.012)	-.004(.003)
Household size	-.130(.070)*	-.031(.016)*
Contact with extension agents (1 if had contact, 0 otherwise)	-1.096(.365)***	-.226(.062)***
Dependency ratio	.011(.145)	.003(.034)
Number of plots	-.307(.119)***	-.073(.028)***
Participation in off-farm employment (1 if yes, 0 otherwise)	-.191(.403)	-.046(.098)
Credit access (1 if yes, 0 otherwise)	.287(.235)	.068(.056)
Vocational training (1 if trained, otherwise)	-.010 (.261)	-.002(.062)
Access to hired non-household labor (1 if has access, 0 otherwise)	-.775(.229)***	-.182(.053)***
Households annual income	-.000(.000)*	-9e-06 (.000)*
Constant	4.906 (.945)***	
Number of obs = 390	LR chi2(11) = 48.80Log likelihood = -238.07408	
Prob> chi2 = 0.0000	Pseudo R2 = 0.0930	

Note: Standard errors are in parenthesis; ***, ** and * indicates that coefficients and marginal effects are significant at 1%, 5% and 10% level of significance

Household size is found as an important demographic factor that significantly and negatively affected multidimensional poverty. The marginal effect indicates that, ceteris paribus, a unit increase in household size reduced the probability of falling into multidimensional poverty by 3 percent. This result is consistent with Alemu et al., (2011), who found a negative association between family size and household poverty in rural Ethiopia. This is probably due to the fact that households with a large number of economically active members can engage in a range of labor-intensive farm and non-farm activities to support wellbeing.

Expectedly, household head education shows a statistically significant and negative effect on the household's multidimensional poverty. The marginal effect shows that, other things being constant, for each additional year of household head education, the probability of falling into multidimensional poverty decreases by 2 percent. The plausible reason is that education increases exposure to the external environment, creates awareness to adopt modern agricultural technologies, enhances employment opportunities, and promotes livelihood diversification to mitigate the risk of poverty. Better education facilitates upward economic and social mobility (Harper, Marcus, & Moore, 2003), enhances the probability of being employed and provides higher income, which leads to less probability of falling into poverty (Van der Berg, 2008). The result is in line with studies such as Ambel, Mehta & Yigezu (2015), Bogale, Hagedorn & Korf (2005), Molla, Zemedu & Legesse (2014), and Tigre (2018), which indicated educational attainment of household heads help households to reduce multidimensional poverty.

Contact with extension agents has a significant and negative impact on household multidimensional poverty. The size of marginal effect shows that household contact with agricultural extension agents reduces the probability of being multidimensionally poor by 23 percent, holding other factors constant. The logic behind this is that households who have contact with extension agents could receive information and training on improving crop production techniques, modern agricultural technologies, and diversification of income-generating activities, and thereby reduce poverty. In addition, the more households have contact, the more they acquire advisory services on crop and livestock production and institutional support such as mobilizing agricultural and financial cooperatives and veterinary services, which are important to reduce household poverty. This result is similar to the findings of Adugna and Sileshi (2013).

In rural areas, family members are the main source of household labor. However, households may face seasonal labor shortages due to the fact that household members may stay away from the farm in search of paid work in urban or other areas. Besides, some households may not have adequate household labor to pursue farming activities. In such cases, households need additional labor to run farming activities such as sowing, weeding, harvesting, and livestock rearing, which demand sharing non-household labor. In light of this, access to hired non-household labor is found to have a significant and negative impact on household's poverty. The probability of being multidimensionally poor dwindles by 18 percent among households who have access to hire non-household labor. This result shows the second most significant determinant of multidimensional poverty in the study area next to the contact with agents.

Another finding also shows that the number of plots is significant at the 1 percent probability level and is negatively affected household's multidimensional poverty. This suggests that households who have more plots of land are less likely to be poor

than those who have fewer. Multidimensional poverty declines by 7.3 percent for a unit increment of the number of farm plots, citeris paribus. Considering the topography and repeated drought of the District, having a greater number of farm plots (from the demand side) helps farmers avoid the risk of crop failure through crop diversification. Having more plots of land may provide leverage over natural calamities (drought) and land degradation from the repeated ploughing of a small and single plot of land. However, the number of farm fields as an indicator of land fragmentation could also have a negative effect on the wellbeing of households since it prevents households from mechanization, thereby decreasing investment and productivity.

Household income is significant at less than 10 percent probability level and negatively affects household multidimensional poverty in the study area. The marginal effect for income shows that a1 Birr (US$0.0365, average in 2018) addition to the household income reduces the probability of being multidimensionally poor by 0.0009 percent. The logic is probably that income is a means of obtaining various livelihood goods and services. Income allows households to function financially, maintain health and living standards, and strengthen household safety nets by creating new opportunities. Furthermore, it is a financial asset which households can save a portion to use as insurance against risks to adverse events, such as drought. This finding is similar to the result of Adugna and Sileshi (2013), who revealed that the household annual income is correlates with the probability of being poor. Income is one of the most important indicators of socioeconomic development. Its inclusion as a monetary factor of poverty in this analysis is essential as it can influence a wide range of household material resources or wellbeing dimensions.

Unlike the findings of previous studies (Hayyat & Chughtai, 2015; Mekore &Yaekob, 2018; Molla et al., 2014; Afera, 2015), training, participation in off-farm employment, and access to credit was not found to have a statistically significant effect on household poverty, despite the essential contribution in multidimensional poverty reduction. This may be generally explained by the low level of training frequency/quality, low access to off-farm employment, and the existence of inadequate credit access in the study District.

4.0 Conclusion and Implications

The study examined the determinants of multidimensional poverty in the Degu'a Tembien District, Northern Ethiopia. Up on classification of households as being multidimensionally poor and non-poor through weighted deprivation scores using 13 indicators, the socioeconomic factors that determine household multidimensional poverty were analyzed using logistic regression. Multidimensional poverty is a complex and deep rooted problem in the study District. Our findings show that the proportion of households living in poverty is higher if measured by multidimensional deprivation perspectives. Various studies (Dercon, Hoddinott, & Woldhanna, 2005; Alemu et al., 2011; OPHI, 2018; Alkire & Kanagaratnam, 2018) have also shown that poverty in Ethiopia is high and persistent; this study supports these insights by looking into the factors that explain household poverty. With this regard, we find that household multidimensional poverty was significantly and negatively affected by contact with extension agents, the education level of the household head, access to hiring non-household labor, number of plots, household size, and household's annual income.

The policy implications of the above results, particularly for a country like Ethiopia, where a great proportion of households lives in multidimensional poverty, are enormous. The negative effect of being in contact with extension workers on household poverty calls for the provision of a wide range of extension services, particularly focusing on increasing productivity through adoption of modern agricultural practices and technologies, capacity building, and awareness creation. The negative effect of household heads education on household poverty calls policies to focus on educational opportunities as it provides the basis for coping with poverty through creating better employment opportunities and a more efficient and productive use of other capitals. The number of plots is significant and negatively affects multidimensional poverty, signifying that more plots reduce household multidimensional poverty (from the demand side). However, the land area in the study District is very small and difficult to expand due to demographic pressure. This suggests interventions to focus on increasing agricultural productivity through the intensification of the fragmented land. Promoting rural labor market/employment and improving household income through ensuring higher returns on cultivated produce should also be an important focus of policy interventions to reduce household multidimensional poverty.

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