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Analysis of Rural Household's Multidimensional Poverty: Northern Amhara Regional state, Ethiopia

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Abstract: The majority of the individuals in the selected areas were able to stay alive thanks to emergency food supplies and the region's safety net program. More than 30% of households in Gubalafto Woreda, one of the study districts, were living in poverty on an absolute basis (Tesfaye, 2013). Poverty can be assessed using either multidimensional or single-dimensional measures. If a person is unable to reach the daily recommended energy using a monetary strategy, he or she is considered to be deprived (either income or consumption). The multidimensional method, on the other hand, took into account a variety of variables that can capture elements that affect individual welfare, such as income, education, health, and basic infrastructure. Uni-dimensional poverty analysis, on the other hand, is unable to depict an individual's or a community's true and comprehensive welfare state, which might portray actual life conditions from various perspectives.As a result, the goal of this study is to use a multidimensional method to quantify the extents and drivers of poverty. A systematic questionnaire-based interview was used to collect the relevant data from 230 randomly selected rural families. The acquired data was analyzed using both descriptive and analytical methods. More than 90% of rural families were judged to be poor in four dimensions using ten dimensions and the generally used Dual cutoff value (K>=0.33). Education, health, clean water, power, and sanitation, all of which are essential for human capital development and economic success, had been denied to a large number of people. Demographic factors, educational level, distance to the major market, off-farm income involvement, and shock all have a substantial impact on multidimensional poverty status, according to the analysis. As a result, the responsible body should work to expand educational services, energy, clean water, and other fundamental infrastructure.

Key words: 1. Rural Households 2. Multidimensional Poverty

Introduction

Poverty is traditionally described as the inability to buy adequate food and other basic requirements. The focus of this concept is solely on material deprivation or a lack of access to private resources or income. Individual well-being, on the other hand, extends beyond the availability of private resources to encompass communal resources such as energy, infrastructure, education, health, clean water, sanitation, and so on. There is no one-size-fits-all strategy to measuring poverty (World Bank, 2005).The most popular methodologies to evaluating poverty are one-dimensional and multidimensional approaches. Poverty is quantified globally using a household's or an individual's income or consumer spending. In the lack of a comprehensive data sheet that includes education, income, health, infrastructure, and other factors that can explain an individual's or household's well-being, scholars can only use consumption or income as a proxy variable to determine whether or not a person is impoverished.To assess individual welfare, many researchers adopt a primarily one-dimensional approach (Dangeot et al 2020, Ermiyas et al 2019, Girma and Temesgen 2018, and Nega 2015). In a one-dimensional perspective, a person or a household becomes poor if it cannot afford the daily calorie allowance. However, because it excludes non-monetary elements like education and health, as well as living standard indicators like access to power, clean water, housing quality, and asset holding, this approach alone may be insufficient to quantify households' well-being (Hulme and Shepherd, 2003).Considering households that are only poor in terms of consumption as poor can lead to the exclusion of a considerable number of the poor in other aspects. Alternatively, people who perform poorly in a one-dimensional technique may not necessarily perform poorly in a multi-dimensional approach (Alamayehu et al, 2015). As a result, the results of Uni-dimensional poverty measures did not provide policymakers and policy practitioners with appropriate and comprehensive baseline inputs.Poverty is often the result of a combination of circumstances that go beyond income and consumption, and quantifying it necessitates taking into account a wide range of factors and gaining a thorough understanding of them (Alkire and Santos, 2014 and Morrell, 2011). In contrast to single-dimensional poverty measures, a multidimensional method can help to account for the inconsistencies of single-dimensional incompleteness, and it gauges individual or family welfare by combining both monetary and non-monetary components.The multidimensional poverty index (MPI) requires a person to be deficient in numerous indicators at the same time in a multidimensional approach (Alkire, S., & Foster, J, 2007). As a result, if a person or household is deficient in one-third or more of the weighted indicators, they are considered multidimensionally poor. A multidimensional poverty index was created by combining numerous features (income, education, health, and living standard indicators like power, clean water, and housing quality, among others) that can affect individual welfare into a single indicator.Thus, if an individual's standardized aggregated poverty index falls below a specified poverty level, they are termed poor (Gebretsadik, 2015; Alkire et al, 2013).In history of poverty literature, many scholars used Uni-dimensional approach to measure either individual or household poverty in the rural

area of the country in general. For instance, (Tesfaye, 2013; Ayalneh, 2005; Nega, 2015; Dawit et al, 2011; Muhdin, 2015; and Birhan, 2015) were intensively analyzed the extents and determinants of rural households poverty using Uni-dimensional poverty approach and suggested many possible interventions at a different time. Given uni=dimensional poverty measures, Ethiopian government and various civic society and non-governmental organizations were engaged with different poverty alleviation strategies such as Safety net program, rural household's asset building program, improved seed and hybrid animal provision etc. But, Uni-dimensional poverty analysis unable to provide complete and comprehensive information about the factors that affect individual as well as household's welfare from various indicators. As a results, currently scholars, policy makers and practitioners all over the world recognized that individual or household poverty are multidimensional by nature (Masood et al, 2012 and Sen, 1976). Multidimensional poverty analysis can show the status of individual and household level deprivations from different indicators of welfare measures, such as electricity, water and sanitation, educations, income, basic productive assets those are the engine of overall economic overheads.

In particular, rural part of North Wollo is one of the most drought prone areas among the other Zone in Amhara region. The area is highly characterized with large number of people sustained their life through the emergence relief food aid according to the North Wollo Zone disaster prevention and preparedness office report (2014). The study conducted by Tesfaye (2013) revealed that more than 30 percent of rural households in Gubalafto Woreda, which is one of the three woredas in North Wollo, were unable to afford the required minimum daily calorie intake. People in study area unable escape from poverty traps even if vamoose poverty reduction interventions have been conducted by government and non-governmental organizations. These evidences indicated that people in the study area has multidimensional problems that need a comprehensive multidimensional poverty assessments. In conclusion:

First,because markets for fundamental needs and public goods may not exist, measuring poverty using a single income or expenditure measure is an imperfect way to comprehend the poor's plight. When monetary and non-monetary data are combined, a more comprehensive picture of poverty emerges.

Second, to the best of the researchers' knowledge, no research has been done in this field employing a multidimensional method. As a result, determining the level of poverty and the factors that contribute to it will provide ground-level knowledge for addressing the deep-seated poverty in the studied area. As a result, this research employs multidimensional poverty metrics to account for all aspects of deprivation and to provide insight into specific policy interventions for each deficiency.

Methods and materials

Data type & its method of collections, Sample Size and Sampling Techniques

This research was carried out in three Woredas (districts) in the Amhara regional state's North Wollo Zone. 'Gubalafto Woreda,' 'GedanWoreda,' and 'MeketWoreda' are the Woredas (districts) studied. These Woredas (districts) are the most drought-prone locations, with a huge population of poor people and little infrastructure. The study relied on cross-sectional data acquired at the household level via structured interviews. The appropriate and representative sample was chosen using the probability sampling method. The researchers used multistage sampling procedures to choose 230 sample households.First, the area was separated into two common agro-ecological zones (highland and middle attitude); second, the sample size was proportionately distributed among two agro-ecological zones in each Woreda; and third, the required sample was selected using a systematic selection approach. The number of explanatory factors included in the regression analysis was used to determine sample size in this study (the scholars suggested that, a dependent variable should be supported by a minimum of ten observations).

Method of data analysis

Instead of focusing on a single welfare status indicator, the multidimensional poverty index took into account many deprivations that a household or individual could face. If a household is poor in any of the major indices, such as health, education, or living conditions, it is said to be multidimensionally poor. Multidimensional Poverty Indexes compute a summary poverty statistic for a specific population using a variety of variables, with a bigger value indicating a higher level of poverty.Following the Alkire& Foster 'counting approach, this figure considers both the proportion of the population that is judged poor and the 'breadth' of poverty experienced by these 'poor' households.

Recognizing the limitations of a one-dimensional approach to poverty measurement and the complexity of a multidimensional approach, Alkire and Foster (2011) developed the Oxford Poverty and Human Development Initiative (OPHI) Multidimensional Poverty Index (MPI), as well as the corresponding weighted deprivation index (k) and multidimensional poverty headcount indicator (MDP). K considers three aspects of happiness: health, education, and living standards, with each contributing an equal amount to the index.The quality of the data available, the context of the population of interest, and the study topic all influence the selection of these dimensions and the accompanying indicators of deprivation (Alkire and Santos, 2010). MDP was built using the major dimensions of wellbeing indicators and their related particular indicators.

Table 1.1: Multidimensional Poverty Dimensions

	Main Indicators	Specific indicators
Three broad dimension of poverty	Health	If at least one member of the household was sick and unable to perform his/her normal activities at least for a month.
	Education	If at least one member of the household member has no completed five years of schooling.
	Living standards	If the house is not Corrugated iron sheets or Concrete and cement floor. If the household lacks access to clean drinking water (covered water sources). If the household lacks access to either radio or TV or Mobile. If a rural household owns 0.5 or less timad of land. If a rural household did not have at least one oxen. If the household has no access to electricity either for lighting or cooking.

Sources: adopted from OPHI's

A minimal number of weighted dimensions is defined to classify a household as poor or non-poor, and only those who are disadvantaged in dimensions surpassing this value are considered poor (Alkire and Foster, 2011). The usual cut-off point k>=0.33 or K=4 is used in the study outcome analysis, with variable values of K for the following stated indicators and cutoff points.

Table 1.2: Multidimensional Poverty Indicators and Cutoff Point.

Indicators	**Indicator and Poverty Cut-off Point (deprived)**
Consumption	If the household is below poverty line (unable to afforded the required daily calorie intake)
Health	If at least one member of the household was sick and unable to perform his/her normal activities at least for a month
Sanitation	If the household has no toilet
Education	If at least one member of the household member has no completed five years of schooling
Electricity	If the household has no access to electricity either for lighting or cooking
Housing quality	If the house is not Corrugated iron sheets or Concrete and cement floor

Safe drinking water	If the household lacks access to clean drinking water (covered water sources)
Information	If the household lacks access to either radio or TV or Mobile
Land size	If a rural household owns 0.5 or less timad of land
Oxen	If a rural household did not have at least one oxen

Source: adopted from OPHI's

Identifying Who Is Poor

Sabina Alkire and James Foster of OPHI created the Alkire and Foster (AF) technique for quantifying multidimensional poverty. It is based on the Foster-Greer _Thorbecke poverty measure and entails counting the various sorts of deprivation that an individual or household faces at the same time, such as a lack of education or empowerment, as well as bad health or living conditions. These deprivation profiles are evaluated to determine who is poor, and then a multidimensional index of poverty is constructed (MPI).

The AF technique counts the overlapping or simultaneous deprivations that an individual or household experiences in different measures of poverty in order to identify the poor. The indicators could be weighted similarly or differently. If the weighted sum of a person's deprivations is greater than or equal to a poverty cutoff—such as 20%, 30%, or 50% of all deprivations—they are classified as multidimensionally poor. However, in this study, the most commonly utilized cut off points, such as one-third of all indicators, were used (33 percent).

The most frequent method of calculating poverty is to determine the headcount ratio, which is the percentage of the population who are poor (H). The AF technique creates a distinct class of poverty measures (Ma) that goes beyond the standard headcount ratio after identifying who is poor. In this class, three measures are extremely important.

The proportion of people who are poor in multiple deprivations at varied or specific cutoff points is derived by dividing the multidimesionally poor persons or households by the entire sample size.

The percentage of deprivations experienced by each person or household on average (A), which is derived by aggregating the deprivation scores of the poor and dividing them by the total number of poor persons.

The adjusted headcount ratio (Mo), often known as the MPI, is calculated as follows: This metric indicates both the prevalence of poverty (the proportion of the population living in poverty) and the severity of poverty (the number of people living in poverty) (the percentage of deprivations suffered by each person or household on average).

The researcher employed two independent models for poverty intensity, poverty gap, and poverty severity in the analysis. When the dependent variable is binary, logistic regression is the best estimator. One of the dependent variables in this study is poverty intensity, which is a binary outcome (1 for poor, 0 otherwise). As a result, logistic regression is the optimum method for regressing poverty intensity against explanatory variables. The

intensity of poverty and the poverty gap are another dependent variable in the analysis. The poverty gap is a measurement of how much income or consumption expenditure the poor far from the poverty line have on average.

Furthermore, it could be interpreted as the average amount of resources required to bridge the gap between impoverished people's consumption and the poverty line. Poverty severity takes into account disparity among the poor as well as the distance between them and the poverty line. In both circumstances, the dependent variable's value is observed for the impoverished, but censored at zero for the non-poor.

In this study the sample respondents who are not multidimensional deprived are included with zero values of the dependent variables. The value the dependent variable is not continues for all respondents. The dependent variables with having a zero values for some respondents and non-zero values for the reaming sample respondent estimated using Tobit model which is the hybrid of discrete (probit) and continues (linear regression) model. This model is originated by Tobin (1958) and commonly known as censored normal regression model. It assumes that many variables have a lower or upper limit that known as threshold value. In this case the threshold value is zero, which is the value assigned for dependent variable that rural households are not multidimensionally deprived. For the remaining sample respondents the variable takes on wider ranges of value above the limit.

Thus, the model is specified as follows:

$$Y^* = \beta_1 X_i + \mu_i, \qquad i = 1,2, \ldots$$

$$Y_i = Y^* \text{ if } Y_i \geq 0$$

$$Y_i = 0 \text{ if } Y_i \leq 0$$

Where $Y_i$is the observed dependent variable, in our case children ever born per rural household, Y^* is latent variables which is not observed, Xi is the independent explanatory variables, β unknown parameters and μ_i are the error terms.

Results and Discussions

Household's Headcount Deprivation by Dimensions

Around 88 percent of households were found to be illiterate, according to the findings. In the research region, there are a substantial number of homes where at least one member has not finished five years of schooling. People have limited access to safe drinking water. For example, 62 percent of the households polled do not have access to safe drinking water (including covered water). Furthermore, 56 and 55 percent of homes lack access to electricity and sanitation facilities, respectively.Over half of the inhabitants in the study region do not have access to electricity for cooking or lighting. A large number of people do not have access to bathroom facilities that are scientifically suggested.

When it comes to main asset holdings, more than half of rural households (56%) have a land size of less than half a timad. When rural people lose their crops due to pests, crop disease, bad weather, and other factors, livestock is a vital source of revenue, power, and

risk mitigation. Specifically, when solely considering the primary sources of power in agricultural activities, such as oxen, 38 percent of rural households have less than one ox.

Table 2: Household's headcount Deprivation by Dimensions

S.No	Indicators (variables)	Number of deprived HHs	Percentage of deprived households
1.	Expenditure	76	0.33
2.	Education	202	0.88
3.	Health	90	0.39
4.	Electricity	129	0.56
5.	Clean water	143	0.62
6.	Sanitation	127	0.55
7.	Housing quality	106	0.46
8.	Supportive livelihood	125	0.54
9.	Land size	128	0.56
10.	Oxen	87	0.38

Source: author's computation (2020)

People in the study area build their homes out of low-quality indigenous materials that are highly traditional and undervalued. Wood, med, and grass are used by about 46% of households to build their homes. In terms of the availability of the primary asset of rural households, approximately 56 percent of rural inhabitants own less than half of a hectare of land. This demonstrates that a significant number of households are land-poor.

Multidimensional Deprivation with Different Cut of Points

When different cutoff criteria are taken into account, rural households in the research area end up with two extreme outcomes. Almost all households in the research region are deficient in two dimensions, while a small percentage of households are deficient in more than eight aspects. According to the most commonly used cut-off point, k=0.33, 91.2 percent of households were deprived, and the extent of their deprivation decreases as the number of dimensions increases.

Table 3: Multidimensional Headcount Ratio (H_0), poverty gap (A) and poverty severity (Mo)

S.No	Poverty cut of (K)	Ho	A	Mo
1.	1	1	.550	0.550
2.	2	1	.550	0.550
3.	3	.992	.553	0.549
4.	4	.912	.575	0.524

5.	5	.768	.608	0.467
6.	6	.516	.661	0.341
7.	7	.232	.735	0.171
8.	8	.076	.805	0.061
9.	9	.004	.900	0.004
10.	10	0	-	-

Source: author's computation (2020)

According to the adjusted head count ratio, 52.4 percent of the households were below the multidimensional poverty line. As k increases, the adjusted head account ration decreases. According to the data, the proportion of dimensions in which the poor were deprived grew as K increased.

Relative Contribution of Dimensions to MPI

The extent of poverty is determined by multiple deprivations in a multidirectional poverty study, which means that deprivation in several dimensions contributes to the multidimensional poverty index. Table 4 shows how each factor contributes to the multidimensional poverty index for households. Education deprivation is the leading cause of multidimensional poverty. The second largest factor to the overall multidimensional poverty level was health deprivation.

Table 4: Relative Contribution of dimensions to MPI

Dimensions (K=0.33)	MPI
Expenditure	0.01
Education	0.51
Health	0.23
Electricity	0.05
Clean water	0.06
Sanitation	0.05
Housing quality	0.04
Supportive livelihood	0.05
Land size	0.02
Oxen	0.01

Source: author's computation (2020)

If multidimensional poverty in the research area is to be reduced, it is critical that this knowledge be used to target each dimension. Because of the dimensional deprivation, any efforts to address the problem of multidimensional poverty in the research area should focus on the education and health sectors first.

Overlap of Consumption Based Poverty andMDEP

Taking both the multidimensional and one-dimensional cut-off points into account, 23 percent of rural households were poor, and just 6% were non-poor in both dimensions, although 46 percent of multidimensional poor households were non-poor unidimensionally.

Table 5: Overlap of consumption-based poverty and MDEP

MDEP	Poor	Poor	Non-poor	Non-poor	Overlapping
Consumption based	Poor	Non-poor	Poor	Non-poor	
Overall sample	75(23%)	153(46%)	1(0.001%)	21(6%)	96(29%)

Source: author's computation (2020)

As a result of the study, households were found to be severely disadvantaged in multidimensional indicators other than income poverty. People in the study region are severely underserved and should be given special care.

Econometrics Analysis of Multidimensional Poverty

The results of the analysis demonstrate that demographic factors such as the gender of the household head, the age of the household head, and the size of the family have a substantial impact on multidimensional indices.

Table 5: Determinants of multidimensional poverty indexes

Dependent variables	Independent variables		
	Headcount Ratio (H_0), using Logit model	poverty gap (A) using Tobit model	poverty severity (Mo), using Tobit Model
Gender of household head(1=male, 0, otherwise)	-1.708(0.979)*	-0.088(0.358)**	-0.088(0.358)**
Age of household head	-0.632(0.022)***	-0.004(0.001)***	-0.004(0.001)***
Family size	0.346(0.198)*	0.029(0.009)***	0.029(0.009)***
Educational level of household head	-1.608(0.901)*	-0.063(0.048)	-0.063(0.048)
Access to irrigation	-0.538(0.704)	-0.062(0.031)**	-0.062(0.031)**
Access to extension services	-2.159(1.442)	-0045 (0.047)	-0045 (0.047)
Access to credit	0.238(0.648)	0.009(0.027)	0.009(0.027)
Distance to the main market area	0.015(0.006)**	0.0000(0.000)	0.0000(0.000)
Non-farm income participation	1.322(0.633)**	0.056 (0.026)**	0.056 (0.026)**
Experiencing crop disease & pest sides	1.387(0.731)*	0.055(0.027)**	0.055(0.027)**
Highland agro ecology	-1.333(1.563)	0.010 (0.046)	0.010 (0.046)

Low land agro ecology	-1.293(1.078)	-0.012(0.042)	-0.012(0.042)
Constant	6.254(2.317)**	0.643(0.086)***	0.643(0.086)***

Sources: author's computation (2020)

Education can be a powerful tool for reducing the prevalence of multidimensional impoverishment. Households with irrigable land are less likely than households without irrigable land to be badly impacted by multidimensional deprivation. Multidimensional deprivation indices are influenced by infrastructure (such as access to the main market), off-farm income involvement, and recurring shocks (such as crop disease and pest sides). Participation in off-farm income has a positive impact on multidimensional poverty. It suggests that persons who participate in non-farm income participation do so because of pushing rather than pulling causes.

Conclusion and Policy Recommendations

The study discovered a scarcity of infrastructural facilities such as potable water, power, and a primary market, all of which can help diversify revenue sources and reduce poverty in the studied area. As a result, the government should extend those services, particularly electricity, safe drinking water, and major highways.

In the research area, there is a substantial correlation between demographic variables and multidimensional deprivations. As a result, the existing health extension package should be properly and efficiently deployed in order to restrict fertility rates and ensure that future generations are healthy.

People who have a well-educated household leader are less poor than their counter parts. As a result, in the same way that the government mobilizes and distributes child education, the government should mobilize and distribute adult education at the local level to all family members.

People who live distant from the main road are poorer than those who reside near the conveniences on the major road. This may have a substantial impact on the diversification of income sources. As a result, the government and the community should collaborate to improve road infrastructure. Participation in off-farm income has a substantial impact on multidimensional poverty reduction strategies.

As a result, the government, NGOs, and local development unions should all work hard to provide the rural community with the necessary skills to engage in a variety of income streams.

To summarize, health services, adult education, energy, clean water, information access, basic assets, and infrastructure facilities are all in short supply in the research area. As a result, these fundamental engines for total economic overheads and human capital development should be major concerns and developed in order to free people from chronic multidimensional deprivations.

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