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APPLICATION OF ORDERED LOGIT MODEL TO ANALYZE DETERMINANTS OF RURAL HOUSEHOLDS MULTIDIMENSIONAL POVERTY IN WESTERN ETHIOPIA

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ABSTRACT: *Rural households' multidimensional poverty is still widespread and severe everywhere. For instance, worldwide a total of 1.45 billion people from 103 countries are multidimensional poor, most MPI poor people (72%) of them live-in middle-income countries. In East Africa, 559 million (42%) people are multidimensional poor. In Ethiopia, the new global 2018 multidimensional poverty index revealed that 49% of the Ethiopian population is multidimensional poor. A thorough analysis of the nature and determinants of multidimensional poverty is a key input for interventions to curb this horrific enemy of mankind. Thus, the general objective of the current study is an analysis of the status and determinants of rural households' multidimensional poverty in Jimma Geneti woreda (Ethiopia). A mixed-methods approach is used to achieve the research objective. Primary data are collected from 387 randomly selected rural households using survey questionnaires. In the analysis of the data, both descriptive and inferential statistics are used. The ordered logistic regression model is employed to investigate the determinants of being multidimensional poor. Results of the descriptive analysis show that 80.1% of the sample respondents are multidimensional poor. The intensity of poverty is 66.3% and the adjusted headcount ratio is found 53.1%. Dimensionally, the living standard dimension is the highest contributor to the overall multidimensional poor of the sample households (42.5%) followed by the education dimension (36.7%) and health dimension (20.9%. Among eleven multidimensional poverty index indicators, school attendance indicators (19.9%) and years of schooling indicators (16.8%) have the highest relative contribution to the overall multidimensional poverty index of the study area. The coastal area has contributed a total of 28.1% to the overall 80.1% of the incidence of poverty. Furthermore, results of the regression analysis indicated that kebele dummy, marital status, literacy status, farm size, and membership to cooperatives of households are found significant determinants of households being multidimensional poor. Policy implications that give top priority to living standard, education, and health dimensions respectively, that benefit sample households from the coastal area and that give due consideration to significant variables in poverty reduction efforts required.*

KEYWORDS: Rural households, multidimensional poverty, ordered logit (ologit) model, *Jimma Geneti woreda*, Ethiopia

INTRODUCTION

Poverty is one of the dehumanizing aspects (food insecurity, livelihood insecurity, drought, and famine) of human beings. Different people respond differently to the concept of poverty. Some respond in simple

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economic terms where poverty is a lack of income or consumption or proportion of people's below the conventional poverty line perspective (Nunes, 2008: Rahman & Titmir, 2013; Noglo, 2014; Laderchi, 2015; Suppa, 2016). Others view it from the social exclusion approach that conceptualizes poverty as a lack of denial of resources, rights, goods, and services, and inability to participate in normal relationships and activities (Mebta, 2002; Ramachandran, 2016). Still, others define poverty from a participatory approach here poverty is voiceless of the poor people (Chambers & Conway, 1992; Chambers, 1994 a; b; Narayan & Nyamaya,1996; Zaid *et al*., 2006; Leavy & Howard, 2013; Hinds, 2013). Yet more, others respond from the capability approach that poverty is multidimensional phenomena denoting that poverty is a lack of capabilities[1] or deprivations like low levels of health and education, poor access to clean water and sanitation, inadequate physical security, lack of political voice, and insufficient capacity and opportunity to better one's life (Sen 1976; 1981; 1985; 1992). Building on Sen(1981) capability theory other studies like Alkire & Santos (2010a;b;c), World Bank (2004; 2014), Alkire & Foster (2008;2011), UNDP (2014a;b), Voola (2010), Poolman (2012), Anaafo (2014), Mahadew (2015), OPHI (2017;2018), and Alkire & Jahan (2018) underscore that poverty is multidimensional phenomena requiring a multidimensional approach, i.e., capability approach defines poverty as deprivation of part or whole of capability sets such as freedom, technology, assets, skill, knowledge, the longevity of life, and a decent standard of living.

Corresponding to the diverse conceptualizations of poverty, its measurements are also diverse. For example, the economic approach to poverty is measured by Foster–Greer–Thorbecke/FGT indices (Nunes, 2008: Rahman & Titmir, 2013; Noglo, 2014; Laderchi, 2015; Suppa, 2016). The social exclusion approach to poverty is by social exclusion index (Mebta, 2002; Ramachandran, 2016). A participatory approach to poverty measured poverty by participatory poverty analysis/PPA techniques like wealth ranking problem analysis; transact walk, social mapping, and consensus-building among participant groups (Chambers & Conway, 1992; Chambers, 1994 a; b; Narayan & Nyamaya, 1996; Zaid *et al*., 2006; Leavy & Howard, 2013; Hinds, 2013). Very recently, the capability approach to poverty estimated poverty by multidimensional poverty index/MPI indices (headcount ratio/H, poverty intensity/A, and Adjusted multidimensional headcount/M_0)(Alkire & Foster, 2011; Anaafo,2014; OPHI, 2017, Alkire & Jahan, 2018).

Different concepts and measurements of poverty are described above. For the theoretical foundations of multidimensional poverty; there are four theories/approaches to multidimensional poverty analyses. First, the theory of the Fuzzy sets/ Fuzzy approach (TFA) is about the need for the characterizations of a whole series of variables/ particular aspect of poverty (Filippone, Cheli, & Agostino, 2001; Lutz, 2004; Deutsch & Silber, 2005; Costa & Angelis, 2008; OPHI, 2009; Betti, Gagliardi, & Salvucci, 2014). Second, the information theory denotes that to identify the household as poor or not poor, weights are required to be assigned to the indicators (Deutsch & Silber, 2005; Lugo &Maasoumi, 2007; Kakwani& Silber, 2008; Asselin, 2008; Vivien, Blaise, Alexis, 2013; Aberg & Brandoline, 2014). Third, the efficiency analysis approach denotes the need to brought information into composite/aggregation index (Deutsch & Silber, 2005; Wagle, 2007; OPHI, 2014a; Alkire, Foster, Seth, Santos, Roche, & Ballon, 2015; Afonso, LaFleur, and Alarcon, 2015; Wang & Wang, 2016). Fourth, Sen (1981) capability theory and axiomatic derivations approach, aimed at designing poverty indices (Deutsch & Silber, 2005;

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Chakravarty, 2006; Alkire & Foster, 2008;2011; Rolf &Eugenio ,2012; Datt, 2013;2018; Rolf & Andrea, 2014; Dhongde & Haveman, 2015; Bérenger,2016).

Indeed, the current analysis of multidimensional poverty is guided by Sen's capability theory [axiomatic deprivation approach]. Several justifications are made. For example, its aggregation of shortfalls of all individuals is among these justifications. That is, the basic idea of axiomatic deprivation approach to multidimensional poverty, analysis is that an index of multidimensional poverty is an aggregation of shortfalls of all individuals where the shortfall concerning a given need reflects the fact that the individual doesn't have even minimum functioning vectors (Deutsch & Silber, 2005; Chakravarty, 2006; Alkire& Foster, 2008; 2011; Rolf & Eugenio, 2012; Rolf & Andrea, 2014; Dhongde & Haveman, 2015; Bérenger, 2016). Besides, the multidimensional poverty index/MPI has been considered as a more important tool of measurement and analysis of household-level multidimensional poverty in health, education, and standard of living compared to the commonly used income-based measurement (Alkire & Foster, 2011; UNDP, 2014a; b). Furthermore, MPI as a method can be readily adjusted to incorporate alternative indicators, cut-offs, and weighs that might be appropriate in regional, national, or sub-national contexts, thereby, fulfill the sets of axioms for multidimensional poverty measurement (Alire & Santos, 2010a) is another justification to why this study is guided by Sen's capability theory.

When poverty is estimated using multidimensional poverty index [non-monetary estimation of poverty] previous descriptive empirical results show that worldwide a total of 1.45 billion people from 103 countries are multidimensional poor, of which most MPI poor people (72%) of them live-in middle-income countries(OPHI, 2017). In 2018, 1.34 billion (23.3%) people globally live in multidimensional poverty in 105 developing countries (OPHI, 2018). A declining trend of the proportion of multidimensional poor was observed globally. In Sub-Saharan Africa, for example, in Sierra Leone, 68.3% in 2015 and 64.8% in 2017 population were multidimensional poor in declining trend and highest in the rural area (86.3%) as compared to an urban area (37%)(UNDP Sierra Leone, 2019). It shows the presence of acute multidimensional poverty in the country. Multidimensional poverty is also acute in 40 countries of SSA (559 million people/42%) are MPI poor (Alkire & Jahan, 2018). East African countries' contributions to the 559 million people MPI poor is decomposed and results show that Tanzania (5.5%), Uganda (4.2%), Kenya (3.4%), South Sudan (2.0%), and Ethiopia (15.3%) (Alkire & Jahan, 2018). Besides, Levine *et al*. (2012) who followed the approach proposed by Alkire & Foster (2007) have computed the old national multidimensional poverty index (MPI) for Uganda and found that 89% lived in households where the sanitation facility is either shared or not improved, 74% lived in households without access to safe water, most individuals without material assets, such as a telephone, television and motor vehicle and the health indicators show that in 43% of households a child has died within the past five years. In the case of Ethiopia, UNDP Ethiopia (2018) reported that 88.2% of the Ethiopian population is multidimensional poor in 2011, which means they were deprived in at least one-third of the weighted MPI indicators that put Ethiopia as the second poorest country in the world (OPHI, 2014a). However, the new global 2018 MPI revealed that in Ethiopia headcount (H) was 83.8%, intensity (A=58.5%), and MPI (49%)(OPHI, 2018). The number of MPI poor in Ethiopia is declining from 2011 to 2018. Oromia regional state (location of the current study) exhibits 82.67% multidimensional poverty status (Seff & Jolliffe, 2016).

Besides descriptive results, a deductive review of the econometric results of different studies shows that globally multiple determinants factors have been found as the causes of households' being multidimensional poor. For examples, in Pakistan, Sabir *et al*. (2006) found that farm productivity, old age of the head, prices of the outputs, bigger household size, lack of infrastructure, and dependency ratio were the major determinants of poverty, however, the education of the head was inversely related to poverty. Another study result by Hashmi *et al*. (2008) shows that the chance of being in poverty increased due to an increase in household size, dependency ratio, education, the value of livestock, remittances, and farming decreased the likelihood of being poor in Pakistan. In Lao People's Republic/LPR Pasanen (2017) used the Alkire & Foster (2007) method and found that household multidimensional poverty is associated with the proportion of children in a household but not with household size. On the village level, multidimensional deprivation is related to low levels of infrastructure and a high prevalence of practicing agricultural activities in LPR. In Sub-Saharan Africa (South Africa for example,), Sekhampu's (2013) study shows that age and employment status of the household head reduces the probability of being poor, while the household size was associated with an increased probability of being poor. Based on Alkire and Foster (2008), Amao *et al*. (2017) have studied on determinants of rural households' multidimensional poverty in Nigeria and results show that household size, gender, year of education, the share of dependent on the household head, land ownership and non-agricultural wages were significant determinants of poverty in Nigeria. In East Africa, household size has significantly contributed to MPI poor in Uganda, other factors constant (Levine *et al*., 2012). In Eritrea, Bahta & Haile (2013) made analysis f rural household multidimensional poverty and found that poverty status was negatively associated with education level, type of resident, size of land, number of meals, remittance, access of credit from relatives, credit institutions, opinion to credit, rain-fed crop, irrigated crop, income from agriculture and income from non-agriculture. However, family number, number of children, children at school-age, and rent of land highly positively related to poverty.

A case study by Alemseged (2016) in Ethiopia found that sex (being male-headed household) and level of education of the household head (being illiterate or attended religious/traditional school) and distance to the nearest market increases the probability of the household being MPI poor whereas ownership of radio, the size of the cultivated land, and the size of tropical livestock unit (TLU) cattle reduce the probability of the household being MPI poor. Similarly, Desawi (2019) revealed that household size was found an important demographic factor that significantly and negatively influenced multidimensional poverty, coefficient of household education was a negative and statistically significant and important determinant factor, and household contact with extension agents was statistically significant and negatively associated with the household's MDP. Both Alemseged (2016) and Desawi (2019) used a binary logistic regression model. Girma and Temesgen (2018) have assessed the determinants of multidimensional poverty in Doyogena district, Southern Nations, and Nationalities/ SNNP regional state (Ethiopia). They also used binary logit model in their study and results show that the number of livestock in tropical livestock unit, participation in off-farm income activities, and age, use of improved seeds, total land size holding, family size, and access remittance income is found to be significant determinants of households' poverty and all of them are inversely related to it, whereas, age dependency the ratio is significantly and positively correlated to households' poverty, the probability of a household being poorly increased due to its dependency ratio. Jimma Geneti woreda is among the woredas of the

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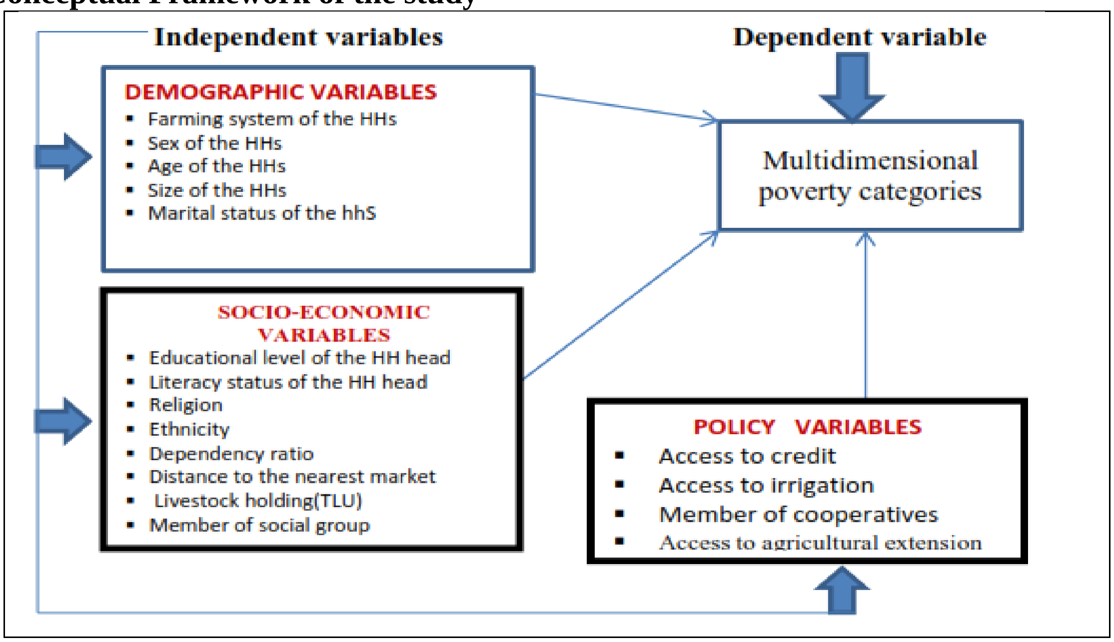
Oromia regional state. A multidimensional poverty index is a composite result of three dimensions (health, education, and living standard) (Alkire & Jahan, 018). Using these three dimensions, no scientific measurement of rural households' multidimensional poverty is made for the woreda. Engulfed by several constraints (fluctuation of rainfall, increased costs of agricultural input, a large number of unproductive labor, the backwardness of work culture, undeveloped working culture, land degradation, and loss of fertility) (Woreda Finance and Economic Development Office, 2017), traditional agriculture has been the major source of rural households' livelihood in the woreda.

Similarities and differences between the current study and some previous studies (Sabir *et al*., 2006; Levine *et al*., 2012; Ballon & Apablaza, 2012; Bahta & Haile, 2013; Bruck & Sindu, 2013; Sekhampu, 2013; World Bank,2014; Seff & Jolliffe, 2016; Alemseged, 2016; Pasanen, 2017; Amao *et al*., 2017; Adepoju,2018; OPHI, 2018; Girma & Temesgen, 2018; Desawi,2019) is identified. Both applied similar theoretical orientations i.e. Sen's (1981) capability theory and methodological approach (axiomatic deprivation). This shows us that in analyzing rural households' multidimensional poverty, there are no differences in the theoretical foundation and methodological approaches to identify the MPI poor from non-MPI poor between previous studies and the current study. The type and numbers (three dimensions of MDP: health, education, and living standard dimensions) used in the analysis of households' multidimensional poverty profile are also the same. However, the gap between the previous scholars' works and the current study lies in several critical differences. *Firs*t, difference in number and composition of indicators in the MPI used. To identify the poor from non-poor, the previous studies have employed deprivation indicators of Alkire & Santos (2010a; 2010b; 2010c; 2013) and that of Alkire & Foster (2008; 2011). Based on these deprivation indicators they have computed the aggregate of their respective MPI results. However, according to Alkire &Jahan (2018) revised new global 2018 MPI indicators such as deprivation indicators used by the previous scholars are old global MPI indicators resulting in the aggregation of the old MPI results. However, the current study is conducted based on the new type and the number of MPI indicators suggested by Alkire & Jahan (2018) (see, Table 1). A slight modification is made with the nutrition indicator of Alkire & Jahan (2018). In doing so, this study is found most significant to widen the knowledge source on rural multidimensional poverty analysis literature.

Second, previous studies have computed their respective old MPIs based on a deprivation cutoff point of 1/3 (33.3%).To the extent of the knowledge of the researchers, all the previous multidimensional poverty researchers failed to decompose their respective MPIs into different MPI categories. Rather they decomposed it into two categories as MPI poor and MPI non-poor. The only attempt made to decompose old MPI results as nearly MPI poor, vulnerable MPI, and severe MPI poor did Batana (2008), Alemseged (2016), and OPHI (2017) make a study. Thus, based on the new global 2018 MPI cutoff points, the current study fills the gap and contributes to rural household multidimensional poverty literature by decomposing the MPI poor result of the study area into four categories/ multivariate. For example, every person with a deprivation cut-off score (K) less than 0.2% identified as MPI non-poor, $0.2<K<0.333$% MPI vulnerable, $0.333<K<0.50$ MPI poor, and greater than or equal to 1/2 (50%) severe MPI poor (Alkire & Jahan, 2018). Such decomposition of rural poverty will help policymakers and planners to comprehensively identify who are poor and who are not, thereby, by giving priority to MPI severely poor households, reduce the extent and severity of multidimensional poverty/MDP. *Third*, unlike the previous studies which measured MPI poverty dichotomously into MPI poor and MPI non-poor, the current study measured as a polychotomous variable (there are four possible outcomes such as MPI non-poor, MPI vulnerable, MPI poor, and severe MPI poor) following Adepju (2018), and employed ordered logit (Ologit) model regression analysis. Thus, it could be a relevant methodological contribution to the growing studies on multidimensional poverty. Finally, the current methodological exercise and empirical study are made in a setting (study area) where such studies have never been done. Therefore, the major objective of this study is to analyze the status and determinants of rural households' multidimensional poverty in Jimma Geneti woreda (Ethiopia). Two basic research questions are set: What is the current status of rural households' multidimensional poverty? What factors could significantly influence sample households heads MPI poor? Based on the review of theoretical, methodological, and empirical reviews, the researchers established the following conceptual framework that guides the study.

Fig 1: Conceptual Framework of the study



Source: Own frame (2019)

DATA AND METHODS

The study area: Oromia regional state is divided into eighteen administrative zones of which *Horro Guduru Wollega* Zone is the one. It is divided into nine *Woredas* of which Jimma Geneti *woreda* [location of the current study] is the one. According to Jimma Geneti *Woreda* Finance and Economic Development office (2017), the study woreda is located 287 Km away from Addis Ababa on the way to Nekemte asphalt road and 27Km away from *Shambu* town (zone capital). The total number of rural population was 78, 981 (Male = 39,183 and Female= 39,798) (*Woreda* Finance and Economic Development office, 2017).

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For the current study, the study researchers have categorized the description of the sample study *kebeles* into three different farming systems: *Highland* (where there are no Teff & Maize production in the kebeles but Wheat, Barley, Bean, Pean, and other highland crops are most characterized the *kebeles* like Adili Leka Tullu Chali and Gamo Negero), *Plain area* (where Teff, maize, and noughe production dominated kebeles like Charo Gobeno, Lalisa Biya, Hagaya, Gudetu Jimma and others), and *Coastal area* of *Fincha'a Lake* (there are Teff, Maize & fishing production dominated and characterized kebeles like Balbala Sorgo, Kalala Didimtu, Gidami Dambsho, Gudetu Geneti, and others. The woreda is divided into twelve rural *kebeles* and two towns (see, map of Jimma Geneti Woreda):

Figure 2: Map of the study area (Jimma Geneti Woreda)

Fig.2a: Woreda map by sample kebeles

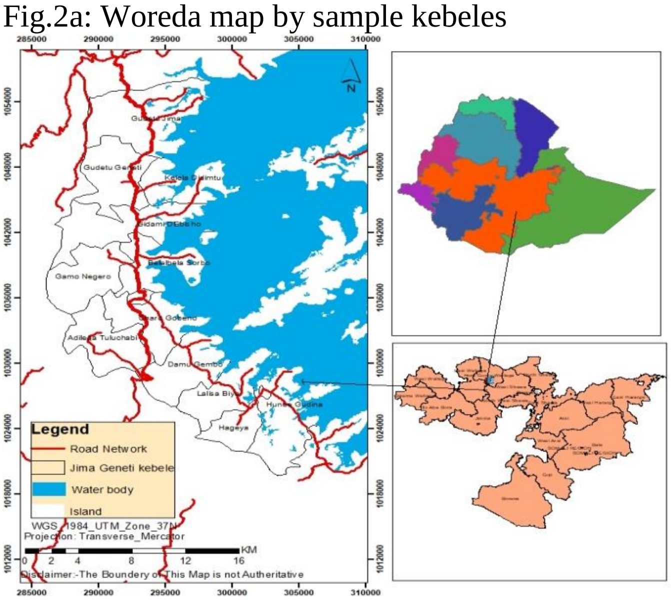
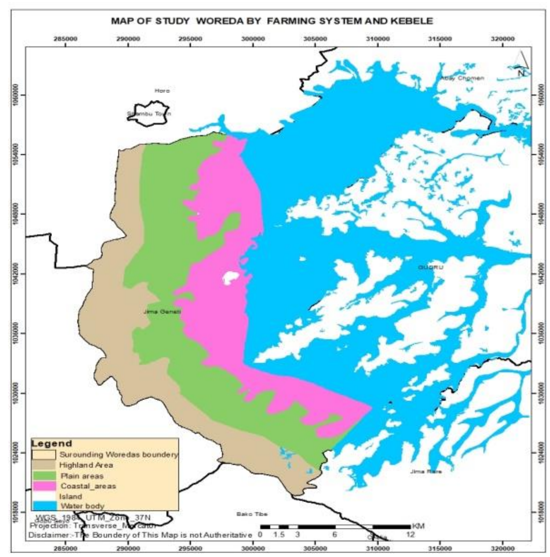


Fig 2b: Woreda map by farming and kebeles



Source: Ethiopia Mapping Agency, expert assisted map (2021)

To different development domains, for example, health dimension, the top ten diseases in the woreda were acute upper respiratory, acute febrile illness, Pneumonia, diarrhea, infection of the skin, dyspepsia, disease of the muscular, other diseases and infective, trauma, and urinary tract infection cases and the maternal mortality ratio/MMR= (Number of mothers died /total number of mothers)*1,000) was 0.66 caused due to major causes such as hemorrhages, abortion, and obstructed labor (Jimma Geneti Woreda Health Office, 2017/2018). For the status of education dimension in the study Woreda, secondary data from Jimma Geneti Woreda Education office (2017/2018) show that from grade 1-4 (first cycle primary education), there are 14 rural schools in 2017 and 2018 and only 1 urban ones. Furthermore, concerning the number of enrolled and dropouts in 2009 & 2018, the document shows that in 2017, there are 9,752 (Male= 5,065 and Female= 4,687) enrolled children and of which 222 children (Male=124 and Female= 612) dropped out from grade 1-4 in the same year. Based on the indicators of **living standards**, according to the secondary data obtained from Jimma Geneti Woreda Water, Mineral and Energy Office (2017/2018), it was found that some of the *cooking fuel/ domestic energy source* is firewood ranked 1st in 2017 and 2018 for both rural and urban households, charcoal ranked 5th in 2017 and 2018 for rural households and ranked 2nd in 2017 and 2018 for urban households, crop residue ranked 2nd in 2017 and 2018 for rural households and ranked 5th in 2017 and 2018 for urban households, animal dung ranked 3rd in 2017 and 2018 for rural households and ranked 6th in 2017 and 2018 for urban households, Kerosene ranked 4th in 2017 and 2018 for both rural households and urban households, too. Concerning sanitation indicators, data was available on sanitation facilities in the formal government school system. For example, during 2017 & 2018, results found only 33 primary schools that have toilet facility.

Besides, *access to potable water* in the study area, out of the total rural population only 66.42% of the rural population was access to potable water sources in 2017 and only 44.8% of the urban population was accessed to potable sources in 2017 in the Woreda. In 2018, only 77.67% of the rural population and 46.8% of the urban population were accessed to potable water. To the *major sources* of potable drinking water in the study area, 1st spring, 2nd Topwater, 3rd River for both rural and urban populations. Concerning electricity, in the study area, out of the total rural kebeles, there are only six rural kebeles who are accessed to a rural electrification program with a total number of rural population 15, 250. No data were available for both sanitation and housing indicators of living standards. Based on the above review of the secondary data, despite some crude data on the three dimensions of multidimensional poverty (health, education, and living standards) were available in the study area, there was no scholarly estimation and analysis of the status of rural households' multidimensional poverty and its determinants. Furthermore, there was no study conducted yet on the qualitative analysis of rural households' poverty in the study area. Furthermore, according to Jimma Geneti Woreda **land** administration office (2017), the secondary data on **land use type** show that, out of the total 410.068 Km^2, cultivated land converted 193.12 Km^2, forest land covered 11.205 Km^2, grazing land covered 39. 655 Km^2 and others covered 166. 0268 Km^2.In the study Woreda, according to Woreda Agriculture and Natural Resource Office (2017/2018), **agriculture** continues to play a dominant role in the livelihoods of rural households' source of income, nevertheless, agricultural production in the woreda has primarily relied on erratic seasonal rainfall, unpredictable & insufficient and as a result, there are repeated failures of agricultural production in the Woreda. Furthermore, concerning the average farm holding size per household in a hectare, secondary data show that the total number of farm landholding size was 19,311 hectares both in 2017 and in 2018. The document revealed that there are 11,877 households in the Woreda and as a result, the average *farm landholding size* (ratio of total farm landholding size to the number of households) in both 2017 and 2018 show that 1.625 hectares each year.

Data type and its sources: Quantitative data type is used in the current study. Both primary and secondary data sources are used. Primary household-level data is collected using a survey questionnaire from 387 randomly selected households. The 387 sample size is determined using a sample determination method proposed by Krejcie & Morgan (1970). Secondary data from publications by government, international organizations, multidimensional poverty researchers, and thesis are also used as major data sources of this study.

Sampling design: According to Jimma Geneti District Office of Agriculture and Natural Resource (2018), the projected number of households are 9,545 households (Male=8,464 households and F=1081 households) living in Jimma Geneti district of which a total of 8,075 (Male= 7,144 and Female= 931)

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are rural households whereas 1470 (Male= 1320 and Female= 150) are urban household heads. Except, the two towns Hareto and kidame Gebeya, twelve rural households (N= 8,075) are considered as the population size (N) of the research. The study utilized multi-stage sampling to select the final units which participated in the study. First, the study woreda is classified into three clusters based on their farming systems as indicated in the description of the study area. Then, the total sample size is allocated to the three clusters depending on proportional sampling to population size. Finally, fairly representative (accommodating gender, age, and socio-economic background) samples are selected from the respective cluster. The survey consisted of several variables of interest to be measured. The multidimensional poverty index dimensions and indicators as well as other independent variables in demographic variables, socioeconomic characteristics, and policy factors are included in the survey. Different measurement scales are utilized depending on the nature of the study variables. The data are collected by trained enumerators under the supervision of one of the researchers using piloted survey questionnaire at a single point in time between November and December 2019.

Analytical Methods and Models

A. Descriptive analysis: MPI indices (incidence of poverty, the intensity of poverty, and adjusted headcount ratio), Spearman's correlation coefficient, percentage, mean, standard deviation, minimum and maximum are some of the descriptive statistics employed in the study. For example, in the construction of MPI indices or parametric classes such as headcount ratio (*H*), poverty intensity (*A)*, and a composite index of deprivation indicators called multidimensional poverty index(*M0)*), Sen's axiomatic deprivation approach is used. That is, following Alkire & Jahan (2018) headcount ratio (H) **(Who is poor?)** is calculated using the formula below:

$$\boldsymbol{H = \frac{q}{n}} \text{ ......(1)}$$

Where, H=head count ratio/ adjusted headcount ratio/percentage of poor households/ incidence of poverty, q=number of multidimensional poor people identified using the dual cut-off approach and n=Total population. Whereas, to calculate the intensity of poverty/A**/ (How poor?)** or the average share of indicators in which poor people are deprived or the proportion of the weighted indicators in which, on average, multidimensional poor people are deprived (Alkire & Jahan, 2018) the equation (2) is employed in this study:

$$\boldsymbol{A = \frac{1}{q}\sum_{1}^{q} C} \text{ ......(2)}$$

Where, A=Average share of deprivation indicators in which the poor people are deprived also called average poverty or poverty intensity [HOW POOR?], q=the number of multidimensional poor people, and C=is the deprivation score of each poor person. It takes the value of ranging between 0 (indicating that the person does not experience any weighted deprivation) and 1 (indicating that the person experiences weighted deprivations in each of the ten indicators). To calculate adjusted headcount ratio (or aggregate MPI (the product of incidence and intensity) (M0), equation (3) is used:

$$\boldsymbol{M_0 = H*A} \text{ ......(3)}$$

Where, M_0=Multidimensional poverty measure/ adjusted headcount ratio (M_0) or aggregate MPI, H=head count ratio, and A=average deprivation share/ poverty intensity. According to Alkire *et al.* (2015), the dimensional contribution to overall MPI can be obtained by adding the MPI share of each

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variable within the dimensions. Concerning the selection/structure of dimensions, indicators, cutoffs, and weights as mapped to the SDGs (see, Table 1).

Table 1: Selection/structure of dimensions, indicators, cutoffs, and weights as mapped to the SDGs

Dimensions of poverty	**Indicators**	**SGD Area**	**Household deprivation cut-offs Deprived if...**	**weights**
HEALTH	Nutrition (adult)	SDG 2	1= if any adult under 70 years of age whom there is nutritional information is undernourished, and 0 otherwise.	1/9
	Nutrition (child)	SDG 2	1= if any child for whom there is nutritional information is undernourished, and 0 otherwise.	1/9
	Child mortality	SDG 3	1= if any child has died in the family in the five years preceding the survey, and 0 otherwise.	1/9
EDUCATION	Years of schooling	SDG 4	1= if no household member aged 10 years or older have completed six years of schooling, 0 otherwise.	1/6
	School attendance	SDG 4	1= if any school-aged child+ is not attending school up to the age at which he/she would complete class 8, 0 otherwise	1/6
LIVING STANDARD	Cooking fuel	SDG 7	1= 1 the household cooks with dung, wood, charcoal, or coal, and 0 otherwise.	1/18
	Sanitation	SDG 11	1= if the household's sanitation facility is not improved (according to SDG guidelines) or it is improved but shared with other households, and 0 otherwise.	1/18
	Drinking water	SDG 6	1= if the household does not have access to improved drinking water (according to SDG guidelines) or safe drinking water is at least a 30-minute walk from home, round trip, 0 otherwise	1/18
	Electricity	SDG 7	1= if the household has no electricity., and 0 otherwise	1/18
	Housing	SDG 11	1= if at least one of the three housing materials for the roof, walls, and floor are inadequate: the floor is of natural materials and/or the roof and/or walls are of natural or rudimentary materials, 0 otherwise.	1/18
	Assets	SDG 1	1= if the household does not own more than one of these assets: radio, TV, telephone, computer, animal cart, bicycle, motorbike, or refrigerator, and does not own a car or truck, 0 otherwise.	1/18

Sources :(Alkire & Jahan, 2018; OPHI, 2017; OPHI, 2018)

To decompose MPI by population subgroups equation (4) is employed:

$$\text{MPI}\ (x, y, z) = \frac{n(x)}{n(x,y)} \text{MPI}\ (x; z) + \frac{n(y)}{n(x,y)} \text{MPI}\ (y; z) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Furthermore, to compute the relative contribution of each group (example, each kebele) to overall poverty, equation (5) is used:

$$\text{Contribution of x to MPI} = \left[\frac{\left[\frac{n(x)}{n(x,y)}\right] * \text{MPI}\ (x,z)}{\text{MPI}(x,y,Z)}\right] * 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

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To compute the relative contribution of each indicator to the overall multidimensional poverty analysis of his study area equation (6) is employed: MPI =w1CH1+ w2CH2 + w3CH3 + …+ wiCH………………………………………………………………...(6)
Where, wi= Weighted indicator I and Chi= censored headcount ratio computed by adding the number of people who are poor and deprived in that indicator divided by the total population. That is,

$$\text{Contribution of indicator i to MPI} = \frac{\text{wiCH}}{\text{MPI}} * 100 \quad \text{.....(7)}$$

The other descriptive statistic, i.e, Spearman's correlation coefficient (see, Bryman & Cramer, 2005) is used to test the sensitivity of the eleven MPI indicators (equation 8).Below is the formula to compute Spearman rank correlation of ordinal variables such as ranks:

$$\rho = \frac{6(\sum D2)}{N(N2-1)} \quad \text{.....(8)}$$

Where, -1≤□≤+1, meaning, correlations less than 0.4 are acceptable implying that avoiding high correlation is vital (Alkire & Foster,2008), that is: .00-1.9 " very weak", .20-.39 "weak", .40-.59 "moderate", .60-.79 " strong", and .80-1.0 "very strong", □= Greek letter rho called Spearman rank-order the correlation coefficient, 6= constant (always used in the formula), D^2 = Difference between subjects ranks on the two variables ($D= R_1-R_2$), and N and N^2 = Number of subjects. Other descriptive statistics like percentage, mean, and standard deviation are used in the data analysis. Simple percentages, figures, and tables were used in the analysis of categorical variables. But mean, standard deviation, minimum and maximum are used for continuous variables.

B. Inferential analysis: to respond to the question of whether there exist statistical differences between multidimensional poverty status of rural household heads and their socioeconomic characteristics, analyses of one-way ANOVA is performed between the dependent variable (deprivation score, abbreviated as "ds" and independent variables. Before employing one-way ANOVA its assumptions are diagnosed first: No significant outliers' assumption, normality assumption using Shapiro-Wilk test of normality and homogeneity of variances assumption using Bartlett's test for equal variances.

C. Econometric analysis: To carry out the analysis of the determinants of rural households multidimensional poverty, Adepju (2018) suggested ordered/logit model. Thus, once households in the study area are categorized into four MPI categories and ensuring that the categories can be arranged in orders, following Adepju (2018), the determinants of multidimensional poverty of the study area are investigated using ordered/logit model. It is expressed as follows:

$$y_i^* = \beta' x_i + \varepsilon_i \qquad -\infty < y_i^* < -\infty \quad \text{.....(9)}$$

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Where, Y_i^* = Multidimensional poverty categories,β_i= Parameters to be estimated, X_i = Observed vector of explanatory variables (see, Table 2, below) which shows the characteristics of the i^{th} household, and ε_i=Residual an error which is logistically distributed.

If Y_i is considered as a discrete (countable) and observable variable which shows different levels of households' multidimensional poverty, the relation between latent variable Y_i^* and observable Y_i is obtained from the ordered logit model as follows:

$$\begin{array}{llll} y_i = 1 & \text{if} & -\infty \leq y_i^* < \mu_1, & i = 1,\dots,n, \\ y_i = 2 & \text{if} & \mu_1 \leq y_i^* < \mu_2, & i = 1,\dots,n, \\ y_i = 3 & \text{if} & \mu_2 \leq y_i^* < \mu_3, & i = 1,\dots,n, \\ \dots & \dots & \dots & \dots \\ y_i = J & \text{if} & \mu_{J-1} \leq y_i^* < +\infty, & i = 1,\dots,n, \end{array} \quad \dots\dots(10)$$

Where, n= value of the sample size, μ and ∞ = Thresholds that define observed discrete answers and should be estimated

The probability of Yi=j should be calculated by the following relation

$$\Pr(y_I = J) = \Pr(y_I \geq \mu_{J-1}) = \Pr(\varepsilon_I \geq \mu_{n-1} - \beta x_I) = F(\beta x_I - \mu_{J-1}) \quad \dots\dots (11)$$

In cumulative probability expression, the ordered logit model estimates the likelihood of household "I" to be at 'J^{th}' level or less (1…, j-1). It should be noted that the answer groups in the ordered logit model are ordered. The ordered logit model is expressed as follows:

$$\log\left[\frac{\gamma_j(x_i)}{1-\gamma_j(x_i)}\right] = \mu_j - [\beta_1 x_{1i} + \beta_2 x_{2i} + \dots + \beta_k x_{ki}] \quad J= 1\dots, J;\ i= 1,\dots,n \quad \dots\dots(12)$$

Making decisions about using variables' value in estimation is very important because the marginal effect depends on the values of all explanatory variables. Since total Probability always equals 1, the total marginal effect for each variable is zero. But it should be noted that the marginal effect is not directly on binary variables, and it can obtain by calculating the difference between the two possible probabilities.

Table2: Table: Summary of explanatory variables used in the Model

S/N	Variable name	Variable code	Variable type	Value	Expected sign
	Poverty/MPI	Poverty category/MPI	Dependent	1=MPI severely poor, 2=MPI poor 3=MPI vulnerable 4=MPI non-poor	
X1	Agro-ecology/farming system	S2_q7	Categorical	1=if highland, 2= if plain area , 3= if coastal area	
X2	Place of residence/kebele	S2_q8	Categorical	12 kebeles	
X3	Sex of HH head	S2_q12	Dummy	1 if male and 0 if female	+/-
X4	Age of the HH head	age	Continuous	1=if less than 35, 2=if 35-64, 3= if 64+ years old	+/-
X5	Family size of the HH head	F_size	Continuous	1= if less than4, 2=if 4-8 , 3=if 8+ number of family	+/-
X6	Marital status of HH head	S2_q15	Categorical	1= if single, 2= if married, 3= if divorced, 4=if widowed, 5= if separated, 6= if polygamy	+/-
X7	The education level of HH head	S2_q16	Ordinal	1= if never attain any primary, 2= if primary, 3= if secondary, 4=if above secondary	+/-
X8	Literacy status of HH head	S2_q17	Ordinal	1= if able to read, 2= if able to write, 3= if able to read, write, & do simple arithmetic, 4=if able to do simple arithmetic, 5= if illeterate	+/-
X9	Religion of the HH head	S2_q18	Categorical	1= if waaqeffata, 2= if orthodox, 3= if Muslim, 4=if catholic, 5= if protestant	+/-
X10	The ethnicity of the HH head	S2_q19	Categorical	1= if Oromo, 2= if Amhara, 3= if Tigray	+/-
X11	Dependency ratio		Continuous	The ratio of dependents to independents	
X12	Livestock holding (TLU)	TLU ??	Continuous	Livestock holding size in TLU	+/-
X13	Agricultural employment status	S4_q72	Dummy	1 if employed and 0 if unemployed	+/-
X14	Landholding (Hectare)	S4_q75	Continuous	The total land size in hectare(2012 EC)	+/-
X15	Access to remittance	S4_q84	Dummy	1 if a HH has access to remittances and 0 otherwise	+/-
X16	Saving	S4_q69	Dummy	1 if a HH has saved and 0 otherwise	
X17	Access to credit	S4_q141_7	Dummy	1 if HH has access to credit and 0 otherwise	+/-
X18	Access to irrigation	S4_q141_8	Dummy	1 if HH has access to irrigation and 0 otherwise	
X19	Membership in cooperatives	S4_q62	Dummy	1 if HHs is a member of cooperative and 0 otherwise	+/-
X20	Access to agricultural extension	S4_q133	Dummy	1 if HHs is accessed to agricultural extension services and 0 otherwise	+/-

Source: (Sabir *et al*., 2006; Ballon & Appablaza,2012; Pasanen, 2017;Adepoju, 2018; Amao et al., 2017; Sekhampu, 2013; Bahta & Haile, 2013; Bruck & Sindu,2013; Alemseged, 2016; Girm & Temesgen, 2018)

RESULTS AND DISCUSSIONS

Status of multidimensional poverty: a descriptive analysis

Test of the sensitivity of MPI indicators: In the presentation and analysis of the test of the sensitivity of MPI indicators, there should not be a significant correlation between MPI indicators. Thus, to complement the subsequent descriptive analysis of rural households' status of multidimensional poverty and to see whether changes in the choice of MPI indicators and dimensional weight could induce significant changes in individuals' deprivation, researchers have made a test of the sensitivity of MPI indicators using Spearman rank correlation (Table 3).

Table 3: Test of the sensitivity of MPI indicators/Spearman correlation between MPI indicators (N=387)

MPI indicators	NA	NC	CM	YS	SA	CF	S	DW	E	H	A
Nutrition /adult (NA)	1.00										
Nutrition/ child (NC)	.514**	1.00									
Child mortality (CM)	-.029	.105*	1.00								
Years of schooling (YS)	.067	.154**	-.093	1.00							
School attendance (SA)	.053	.130*	-.075	.587**	1.00						
Cooking fuel (CF)	-.053	.105*	-.093	.016	.087	1.00					
Sanitation (S)	.069	.085	.071	-.046	-.053	.087	1.00				
Drinking water (DW)	-.139**	-.008	.053	.003	-.017	.015	-.029	1.00			
Electricity (E)	.012	-.028	.038	-.067	-.023	-.035	.101*	.108*	1.00		
Housing (H)	.009	-.007	.123*	-.022	-.089	.077	-.016	.071	.003	1.00	
Asset (A)	-.237**	-.022	.053	-.067	-.119*	-.029	-.061	.270**	.108*	.041	1.00

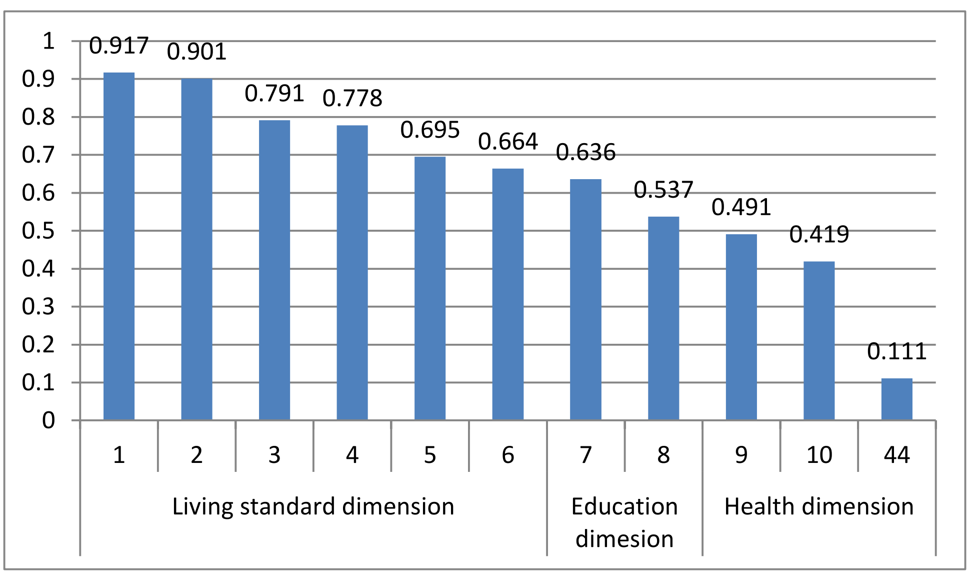
Source: Computed field survey (2019)

Table 3 above revealed that except correlation between child nutrition and adult nutrition (r= 0.514) and the correlation between school attendances and years of schooling (r= 0.587), most of the results of Spearman rank correlation coefficients of the current study depicted in the above Table 3, above shows that it is a weak association between the indicators. Correlations less than 0.4 are acceptable (Alkire & Foster, 2008). This implies that most of the MPI indicator is not significantly explained by deprivation in any other MPI indicator and thus the MPI index of the study contained different dimensions of multidimensional poverty and safe to use the eleven MPI variables in the analysis.

Censored headcount ratio (H): Censored headcount ratio of an indicator represents the proportion of individuals who are multidimensional poor and also deprived in that indicator. To identify sample households as deprived and non-deprived, the weighted deprivation score (Ci) of the rural households and new MPI cutoff (K=0.3667) are highly important(Fig. 3).

i/. Health dimension: Results of the above Figure 3 and Appendix1 show the censored headcount ratio for three MPI indicators under the health dimension. First, nutrition adult indicator- to analyze the results of these three indicators, sample rural household heads of the study area are given code "1" and considered deprived if any adult under 70 years of age for whom there is nutritional information is undernourished. One overweight is attached to the nutrition/adult indicator of the current study. At the same time, to identify MPI poor households under nutrition adult indicator, by using second poverty cutoff or threshold (K=0.3663) censoring of the headcount ratio is carried out for 387 households. Accordingly, the results of the household heads who are both deprived and MPI poor in adult nutrition indicator found as 162 (41.9%). The result was (190/49.1%) for the child nutrition indicator. Likewise, when the data is censored for each household, the majority of them non-deprived 344(88.9%) and MPI non-poor as compared to less proportion of deprived households 43(11.1%) in child mortality indicator. Secondary data source shows that 32 children (male=14 and female=18) in 2016/17 and 36 children (male=36 and female=20) are malnourished (Woreda Health Office, 2017/18) suggesting an incremental trend and more female malnourished children than boys. Furthermore, cross-tabulation of deprivation score of health dimension with poverty categories (Table 4, below) also revealed that sample household heads are both deprived and MPI poor in adult nutrition indicators are found as 162 (41.9%). When 162(41.9%) figure is disaggregated into different poverty categories, it is found that 138(85.19%) MPI severely poor, 7(4.32%) MPI poor, and 17(10.49%) found MPI vulnerable poor. The later poverty category gave an alert that when that many numbers of households encountered any shock or multiple shocks, they may enter into MPI poor or even worse than it. The wider implication of the above two results shows us lower deprivation of sample households as compared to deprivation in other MPI indicators, for example, deprivation in cooking fuel (91.7%).

Fig 3: Censored headcount ratio (households deprived in each indicator and poor at K=0.3663)



KEY:

LIVING STANDARD

1. Cooking fuel
2. Electricity
3. Drinking water
4. Asset
5. Sanitation
6. Housing

EDUCATION

7. School attendance
8. Years of schooling

HEALTH

9. Nutrition child
10. Nutrition adult
11. Child mortality

Source: Computed field survey (2019)

ii/.Education dimension: Under the education dimension, while results of the censored data show that out of 387 rural household heads responded to the survey questionnaire while 208(53.7%) the study area deprived and MPI poor in years of schooling indicator when 208(53.8%) figure is disaggregated into different poverty categories, it is found that 202 (97.12%) MPI poor, 5(2.4%) MPI vulnerable poor, and 1(0.48%) found MPI severely poor. However, the results of the censored headcount ratio of the primary data revealed that 246(63.6%) of the household heads the study area deprived and poor in school attendance indicator when 246(63.6%) figure is disaggregated into different poverty categories, it is found that 221(89.84%) MPI severely poor, 24(9.76%) MPI poor and 1(0.41%) found MPI vulnerable poor. Secondary data source revealed that 17,907 (male= 9,295 and female=8,612) children were accessed to primary education of which 10,483 (male=5,429 and female=5,024 in first cycle/grade 1-4;7,424 (male=3,866 and female=3,558) in second cycle/grade 5-8)(Woreda Education Office,2017/18). Besides, in terms of quality education measured by the proportion of the number of children to the available classroom, it is found that 58:1 (above the 50:1) national average. According to the Woreda Education Office (2017/18), the student dropout rate is another quality indicator was reported 2.9% and with a repetition rate of 4.2% in 2017/18. The same document also revealed the presence of an inequitable distribution of primary education by gender, i.e Gender Disparity Index/GDI of the woreda was computed as 0.93 in 2017/18 showing more boys than girls are in the school. These statistical data augmented by the deprivation indicator results of education dimension imply that access, quality, and equality issue of education in the woreda is not met the global compelling goal of Education for All! Strategic and long-years plans are required to meet access, quality, and equality issues of education of children of the sample household heads in the woreda.

iii/. Living standard dimension:
a. Cooking fuel indicator: The researcher has analyzed the censored headcount ratio (H) for cooking fuel indicator, too. It was found that household heads of the study area highest deprived and poor in this indicator (355/91.7%). When 355(91.7%) figure is disaggregated into different poverty categories, it was found that 250(70.42%) MPI severely poor, 53(14.93%) MPI poor, and 52(14.65%) found MPI vulnerable poor. In contrast to SSA country, the cooling fuel indicator of the current study area is much higher than the censored headcount the ratio for cooking fuel indicator in Sierra Leone that is 27.2% (UNDP Sierra Leone, 2019).

b. Sanitation indicator: Similarly, when the primary data of the current study is censored, it is found that 269(69.5%) of the household heads in the study area deprived and poor in sanitation indicators. When disaggregated into different poverty categories, it was found that 191(71%) MPI severely poor, 43(15.99%) MPI poor, and 35(13.01%) found MPI vulnerable poor.

c. Drinking water indicator: Similarly, when the primary data of the current study is censored, it is found that 306 (79.07%) of the household heads in the study area, the study area deprived and poor in drinking water indicators. When disaggregated into different poverty categories, it is found that 220(71.90%) MPI severely poor, 43(14.05%) MPI poor and 43(14.05%) MPI vulnerable poor, and 1(0.29%) found MPI non-poor in drinking water indicator. In contrast to a similar micro-level study for example by Desawi (2019), censored headcount the ratio for drinking water indicator in is 28%, K=4 (highest censored headcount ratio as compared to other MPI indicators) in Degu’a Tembien woreda, Tigray regional state, Ethiopia.

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d. Electricity indicator: Yet more, when the primary data of the current study is censored, it is found that 269 (69.5%) of the household heads in the study area deprived and poor in electricity indicator. When disaggregated into different poverty categories, it was found that 244(69.91%) MPI severely poor, 53(15.19%) MPI poor,51(14.61%) MPI vulnerable poor, and 1(0.29%) found MPI non-poor. The censored headcount ratio for electricity indicator in Sierra Leone was found as 59.6% (UNDP Sierra Leone, 2019), whereas it was 55%, K=4 (highest censored headcount ratio as compared to other MPI indicators) (Desawi, 2019).

e. Housing indicator: Similarly, when the primary data of the current study is censored, it was found that 57 (66.4%) of the household heads in the study area deprived and poor in housing indicators. When disaggregated into different poverty categories, it is found that 190(73.93%) MPI severely poor, 27(10.51%) MPI poor, 40(15.56%) found MPI vulnerable poor. The censored headcount ratio for asset indicators in Sierra Leone was found as 41.1% (UNDP Sierra Leone, 2019).

f. Asset indicator: Similarly, when the primary data of the current study is censored, it was found that 301 (77.8%) of the household heads in the study area deprived and poor in asset indicators. When disaggregated into different poverty categories, it is found that 213(70.76%) MPI severely poor, 44(14.62%) MPI poor, 43(14.29%) MPI vulnerable poor, and 1(0.33%) found MPI non-poor. Overall, multidimensional poverty among the majority of the rural population means that they are deprived of access to affordable quality services- services that are critical (health, education, and standard of living) to lifting and keeping them out of poverty. For example, in the current study area, the highest deprivations are found in all MPI indicators except for the child mortality indicator (11.6%) for uncensored headcount ratio and 11.1% for censored headcount ratio. The next section computed and presented the results and discussions of the MPI indices.

Computing multidimensional indices/ Parametric classes: Following the procedures of computing MPI indices by Alkire & Foster (2011) and Alkire & Jahan (2018) discussed under data and methods, three MPI indices- the incidence of poverty (H), poverty gap (A) and aggregated adjusted headcount ratio/M_0) is computed. After computations, results are presented in Table 4, below:

Table 4: Parametric class of MPI results of the study area (for 11 indicators)

Poverty cut-off (K)	**MPI indices**	**Value**	**Std. Err**	**Confidence interval (95%)**	
K=36.63%	Incidence of poverty(H=q/n)	0.801	0.020	0.761	0.841
	Poverty gap($A=M_0/H$)	0.663	0.009	0.646	0.680
	Adjusted multidimensional headcount (M_0=H*A)	0.531	0.015	0.501	0.561

Source: Computed from field survey (2019)

A/.Incidence of poverty (H)-prevalence: The incidence of poverty is the number of households who experienced overlapping deprivations. As depicted in Table 4, the percentage proportion of poor household heads (H=**80.1%)** of the study area is computed as a ratio of the number of multidimensional poor household heads identified using the dual cutoffs (deprivation cutoff-Z and poverty cutoff-K). This means, when 3 dimensions and 11 indicators the study area analyzed, about 80.1% of the sample household heads (n=387) of Jimma Geneti woreda the study the area declared multidimensional poor. The current result was higher when compared to the findings of Indonesia incidence of poverty (H)was 32% in 1993, 15% in 1997, 13% in 2000 & 8% in 2007(Ballon & Apablaza,2012), in Sub-Saharan Africa, H=57.8%) in 2018 (Alkire & Jahan, 2018), In Sierra Leone, (H=64.8%) in 2017 (UNDP Sierra Leone, 2019), H=78.1% in Nigeria at K=30% (Amao *et al*.,2017), H=72.2% in Uganda (Levine *et al*. (2012), and H=60.2% for Degua Tembein/Tigray, Ethiopia (Desawi, 2019). However, the result is lower as compared to other Ethiopian studies: incidence of poverty (H= 83%) (Alkire & Jahan, 2018), and (H=84.2%, K equals 3) (Bruck & Sindu, 2013).

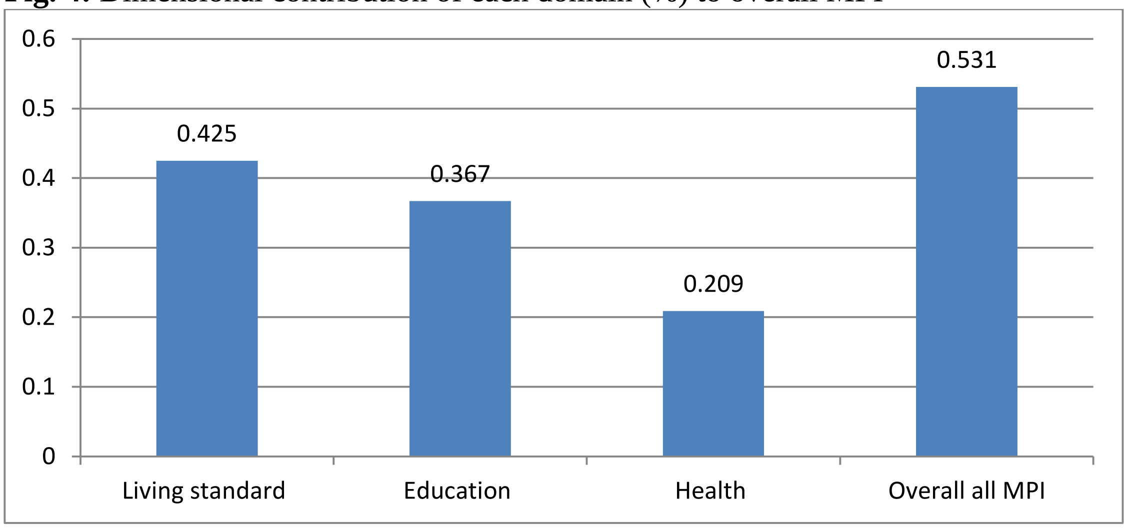
B/.The average share of deprivation (A)-intensity: Intensity of poverty is the average proportion of the weighted indicators in which the poor are deprived. Meaning, the intensity of poverty is about the number of deprivations households faced on average. Because of the drawbacks of headcount ratio (H): violates dimensional monotonicity and dimensional decomposability), the poverty gap (A) of the study area is computed. A result of 66.3% is obtained. That is, each poor person is, on average, deprived of 66.3% of the weighted indicators. It is higher than the national average share of deprivation (A=59.6%) in 2016(OPHI, 2016) and an average share of deprivation (A=58.5%) in 2018(Alkire & Jahan, 2018). Even when compared to other micro-level studies, for examples, in Indonesia intensity of poverty is 42% in 1993, 41% in 1997, 40% in 2000 & 38% in 2007(Ballon & Apablaza, 2012), in Sierra Leone, A=57.9% in 2017 (UNDP Sierra Leone, 2019), A= 52.2% in Nigeria at K=30% (Amao *et al*., 2017), and A= 50.8% in Uganda (Levine *et al*., 2012). In Ethiopia, Bruck & Sindu (2013) found the lower average intensity of poverty (A=44.8%, K equals 3) as compared to the current study area. A relatively less average share of deprivation (A=58.3%) was found by Desawi (2019).

C/.Adjusted headcount ratio (M_0)-composite: adjusted headcount ratio or aggregate of MPI of the study area was computed as a product of headcount ratio (H) and the poverty gap (A). Categorized under severe MPI poor (see, Alkire & Jahan, 2018), results of the multidimensional poverty index (MPI) of the study area are found as **53.1%.** This means, rural household heads of the study area experience 53.1% of the total deprivations that would be experienced if all rural household heads in the study area were deprived in all indicators. It is slightly above Ethiopia's average, MPI poor for Ethiopia was 55% in 2016(OPHI, 2018) and even much higher the MPI result (49%) of Ethiopia (Alkire & Jahan, 2018). Similar micro-level studies reported different adjusted headcount ratios (M0). For instance, a lower proportion of adjusted headcount ratio in Indonesia's aggregate of poverty was 13.3% in 1993, 6.1% in 1997, 5.3% in 2000 & 3.2% in 2007(Ballon & Apablaza, 2012). A lower adjusted headcount ratio (M0) in Sub-Saharan Africa was similarly reported as 31.7% in 2018 (Alkire & Jahan, 2018). Besides, its lower result was found in Sierra Leone at 37.5% in 2017 (UNDP Sierra Leone, 2019) and 41% in Nigeria in 2017, at K=30 % (Amao *et al*., 2017). Higher micro-level result of adjusted headcount ratio or aggregate of MPI (70.35) was reported by Alemeseged (2016) in Werie Leke district, Tigray (Ethiopia).

Dimensions and MPI indicators relative contributions to overall MPI:

A/.Dimensional contributions: The dimensional contribution of the MPI result of the study area was computed and presented in Fig 4, below. It revealed each MPI dimension contributes differently to the overall MPI score, i.e, living standard dimension contributed 42.5%, education dimension contributed 36.7% and health dimension contributed 20.9%. The results clearly show a wide gap between the households living in the three dimensions, implying that the living standard dimension has contributed the most to the multidimensional poverty index of the study area. The living standard dimension should be a policy target to reduce poverty in the study area. Thus, the decision-making of the woreda on budgeting has to geared towards improving the standard of the living conditions of the rural area by providing basic services like cooking fuel, electricity, drinking water, sanitation, and building their assets, too. Similar related studies (Alkire & Santos, 2010a; Levine *et al*., 2012; Amao *et al*., 2017) also revealed standard of living was the biggest contributor to multidimensional poverty.

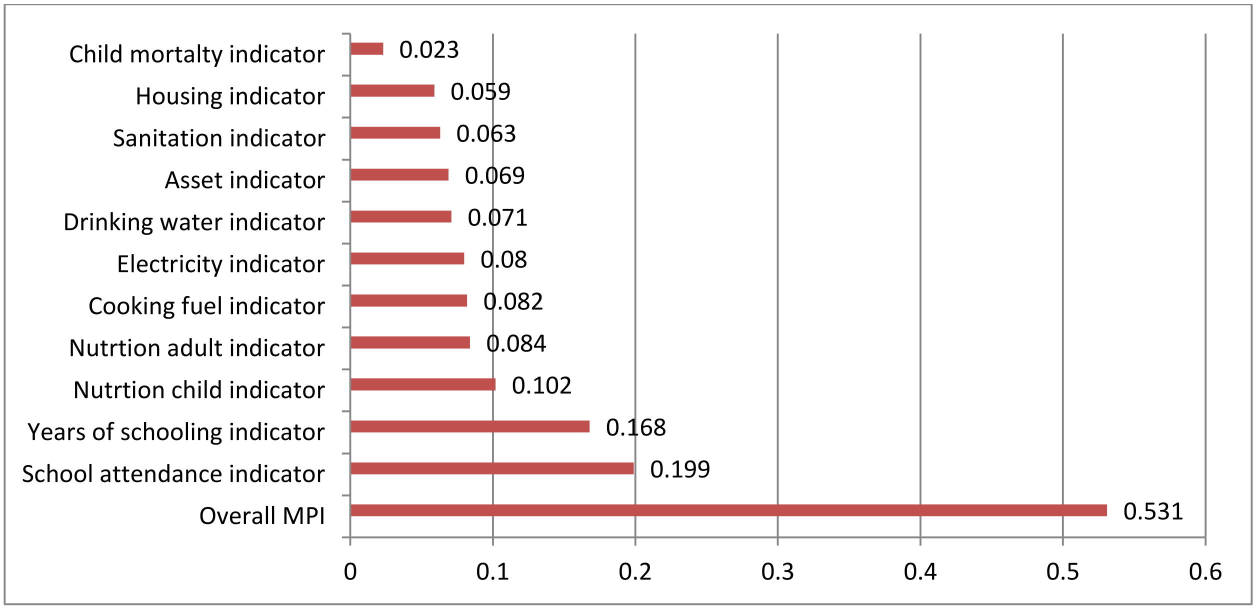
Fig. 4: Dimensional contribution of each domain (%) to overall MPI



Source: Computed from field survey (2019)

B/.MPI indicators contributions: So far decomposition of aggregate poverty (MPI) by dimensions was made. The decomposition of MPI by indicators was another interesting feature of the multidimensional poverty index (MPI). Fig. 5 below presented the relative contributions of the eleven MPI indicators to the overall MPI of the study woreda.

Fig.5: Relative contribution of each indicator to the overall MPI result (%)



Source: Computed from field survey (2019)

Fig 5 above, show that while indicators of education dimensions namely school attendance (19.9%) and years of schooling indicator (16.8%) are the highest contributors to overall MPI, child mortality indicator (0.023) contributes the least that suggest efforts towards improving household multidimensional poverty focus on indicators of the education dimension. According to compulsory education (education for all), all children must attend school without leaving anyone behind. This could ensure that every future adult citizen had all-rounded and functional education. Rural children of the study area deserve this right. Similar studies by Levine *et al*. (2012) and UNDP Sierra Leone (2019) reported that it was the school attendance indicator (28% and 12.3%) that had contributed highest to the overall MPI of Uganda and SierraLeione respectively. A similar study by Alemseged (2016) showed that out of 357 sample respondents, 159 (44.5%) of the study area are deprived of five years of schooling. The previous finding of Alemseged (2016) and the current study was found consistent with OPHI's (2019) report that in Ethiopia half is multidimensional poor and lives in a household in which no one has completed six years of schooling.

The figure also revealed sample household heads in the study area encountered with deprivation of establishing education and health services to their children. The relative contribution of the adult nutrition indicator (8.4%) was comparatively lesser than the relative contribution of the first three MPI indicators (school attendance, years of schooling, and nutrition child indicator) in the study area. In other words, sample households in the study area are deprived of the nutrition of adults. The sample household head who lacks adult dietary variety information increased the number of MPI poor in the study area. Indeed, as adults living with the sampled household heads get older and their bodies have different needs, so certain nutrients become especially important for good health. Such undernourishment of nutrition adults by rural household heads in the study area has negative health consequences for adults in their respective houses. All these data entail us that rural household heads deprived of nutritional information are susceptible to nutritional insecurity at the household level. Unproductivity of the rural household heads of the study area could have a high potential of their vulnerability and severe MPI poor. Compared to the other remaining ten MPI indicators of multidimensional poverty analysis in the current study area, the relative contribution of the child mortality indicator was lowest as it only contributed 2.3% to the overall MPI. Likewise, the child mortality indicator in Uganda also contributed lesser (only 4%) in Uganda (Levine *et al*., 2012). Most of the rural households in the study area usually use wood and agricultural by-products to cook their food. The percentage number of deprived sampled rural household heads in cooking fuel was 8.2%. Thus, since access to energy infrastructure and modern cooking alternatives is still limited in rural areas, the relative contribution of cooking fuel to the overall MPI is (8.2%).

Sanitation refers to public health conditions related to adequate treatment and disposal of human excreta and sewerage. Through sanitation, while it is possible to reduce diarrhea-related deaths of the rural people, the main cause of malnutrition and stunted growth in children, primary data collected from sample household heads of the study area revealed that out of the total 387 samples, 118(30.5%) lived with sanitation facility not improved or improved but shared with other households. The indicator has a total of 6.3% relative contribution to the overall MPI results in the woreda. Accessing rural household heads to improved sanitation has health and productivity effects, an issue that should major agenda of the related public sector in the woreda. While in Ethiopia, 80% is multidimensional poor and lacks adequate sanitation facilities (OPHI, 2019), in Sierra Leone sanitation indicator, contributed 13%, to the overall MPI of the country in 2017(UNDP Sierra Leone, 2019).

Everywhere, the supply of clean water to rural households is challenging. In the case of the current study area it was found that 323(83.5%) of the sample heads deprived of this important public service. As a result, it is found that deprivation of rural household heads in drinking water was, in turn, has a relative contribution of 7.1% to the overall 53.1% MPI poor of the study area. This is to say that out of the total elven MPI indicators, sample household heads having no access to improved drinking water or safe drinking water in at least a 30-minute walk from home, the round trip has a share of 7.1% out of the total overall MPI 53.1% of the study area. The result revealed rural household heads use a drinking water source contaminated with feces, more likely. Contaminated water can transmit diseases such as diarrhea, cholera, dysentery, typhoid, and polio. Contaminated drinking water is estimated to cause diarrheal deaths each year in the sample household heads of the current study.

The relative contribution of the electricity indicator is found as 8% to the overall MPI indicator. Concerning electricity, in the study area, out of the total twelve rural kebeles, there are only six rural kebeles who are accessed to a rural electrification program with a total number of rural population 15, 250 (Jimma Geneti Woreda Water, Mineral and Energy Office,2017/2018). While in Ethiopia, nearly three-quarters of the population is multidimensional poor and lacks electricity (OPHI, 2019), in Sierra Leone cooking fuel, contributed 5.6%, while electricity contributed 12.7% to the overall MPI of the country in 2017(UNDP Sierra Leone, 2019). The urban housing program is the major development agenda of any government for urban households. The provision of housing in rural areas is considered inadequate. The government compared urban households' threats to rural households unequally.

Rural households constructed their housing from rudimentary construction material. Floor, wall, and roof material are constructed unattainably from poor quality rudimentary construction material. Rural households in the current study area are not exceptional. This is revealed by the result of the deprivation of 257(66.4%) heads with at least one of the three housing materials for floor, walls, and roof. In terms of the percentage contribution of the housing indicator, it is found as 5.9%. The asset position of rural households has a paramount contribution to the level of their poverty status. Households with better assets have less probability of encountering severe multidimensional poverty. However, rural household heads with depleted assets have a high vulnerability to multidimensional poverty. Results of the percentage of the households deprived in asset indicator the study area found as 77.8%. Based on this result it was found that the asset indicator of MPI has a relative contribution of (6.9%) to the overall MPI of the study area. Meaning, sample household heads of the study area who does not own more than one of assets like radio, TV, telephone, computer, animal cart, bicycle, motorbike, refrigerator, car, or truck aggravating the status of 58.4% of overall MPI in the study area by contributing a total of 6.9% share.

Decomposition of MPI indices and poverty categories: To begin with, one of the useful properties of the uni-dimensional FGT method is its decomposability. Alkire & Foster (2011) adopted such useful property of the uni-dimensional FGT method in multidimensional poverty index decomposition. By implication one of the advantages of multidimensional poverty analysis are its decomposability and locating the area with the highest incidence of poverty and the composite index. Such MPI decomposition has several aims, among which to make visible different intensities of deprivation-where challenges lie and what needs to be addressed (Alkire & Jahan, 2018), to see how poverty differences exist within a given society (OPHI, 2018). Furthermore, such decomposition is useful to know which population group has a higher proportion of the number of deprived households (H), the extent of intensity of poverty (A), and overall poverty (M_0) of rural household heads experienced multidimensional poverty, thereby, enable development planners and policymakers to budget public money for the poorest of the poor. Thus, decomposition of MPI result by poverty categories and sub-groups (i.e, households' socio-economic characteristics) were made.

A/.Decomposition by poverty categories: The current value of the poverty cutoff (K) was 0.3663. Table 5 revealed the decomposition of MPI results by the poverty category. Table 4 below shows that with a population share of 0.716 and 82.33% contribution, the absolute incidence of poverty (H) is 92.1%) for sample households being MPI severely poor, whereas MPI poor households have a 17.7% contribution to the total incidence of poverty (80.1%). MPI poor households have a population share of 0.142. The absolute intensity of poverty (A) M0 is found 43% each for MPI poor households of the study area.

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Table 5: Decomposition of MPI results by different poverty categories

Decomposition By	**Category**		**H**	**A**	**MPI**	**Pop. share**
Poverty categories	MPI non-poor (Less than 0.2)	Absolute	0	0	0	0.003
		Contribution	0	0	0	
	MPI vulnerable (0.20<K<0.3663)	Absolute	0	0	0	0.14
		Contribution	0	0	0	
	MPI poor (0.3663<K<0.50)	Absolute	1	0.43	0.43	0.142
		Contribution	0.177	1.000	0.177	
	MPI sever poor (>0.50)	Absolute	0.921	0.712	0.656	0.716
		Contribution	0.823	1.075	0.885	
	TOTAL		**0.801**	0.663	**0.531**	

Note: In at least one category, no individual is multidimensional deprived and poor
Source: Computed from field survey (2019)

B/.Decomposition by farming systems: The intention of decomposing MPI indices (incidence of poverty/H, the intensity of poverty/A, and aggregate poverty/M0) by households' farming system was to identify which location is affected by a high incidence of poverty. That is, according to Alkire & Jahan (2018), the global MPI allows to identify the poorest areas and see to what extent people in these areas are being left behind in the dimension of health, education, and living standards. This can be useful for improving policy planning to more precisely target areas most in need. As explained under the description of the study area based on the dominant pattern of farm activities in the woreda the researchers divided the study woreda into three different farming systems: High land, plain area, and coastal area rural households (Table 6).

Table 6: Distribution of MDP by MPI indices, MPI categories, and farming system (N=387)

	MPI indices/poverty categories	Absolute/contribution	Farming system of households			Total
			Highland area	Plain are	Coastal area	
MDP decomposition by MPI indices vs farming system of HHs	Incidence of poverty (H),%	Absolute	0.791	0.785	0.837	0.801
		Contribution	0.390	0.329	0.281	1.000
	Intensity of poverty (A),%	Absolute	0.649	0.660	0.686	0.663
		Contribution	0.979	0.994	1.036	1.000
	Aggregate poverty (M0),%	Absolute	0.513	0.518	0.574	0.531
		Contribution	0.382	0.327	0.291	1.000
MDP decomposition by different MPI categories vs farming system of HHs	MPI sever (K>0.50%)		109	88	80	277
	MPI poor (0.3663<K<0.50%)		26	18	11	55
	MPI vulnerable (0.2<K<0.3663%)		18	24	12	54
	MPI non-poor (K<0.2%)		0	0	1	1
POP.SHARE,%			153 (0.395)	130 (0.336)	104 (0.269)	387 (100)

Source: Computed from field survey (2019)

As indicated in Table 6, in absolute value, **w**hen MPI result is decomposed by farming system, the highest incidence of poverty (H=83.7%) is experienced by rural household heads located in coastal areas or household heads producing Teff, Maize and Fish. The reason may be money. For example, as households are closer to the coastal areas like Fincha'a artificial hydroelectric dam, obviously the swampy area expands. This could affect the wide farmland of rural households. Animals in search of green pasture may sink and die due to the nature of the land around coastal areas. All in all, it may cause the depletion of rural households' livelihoods. In turn, households with depleted livelihoods could have a high probability of multidimensional poor.

Multidimensional poverty is determined by the location of the household heads. Household heads located in resource-rich areas are less likely to be multidimensional poor as compared to household heads located in resource depleted areas. In terms of contribution, the coastal area has contributed a total of 28.1% to the overall 80.1% of the incidence of poverty. This is followed by highland area households' incidence of poverty (H=79.1%) which has contributed a total of 39% to the overall incidence of poverty. However, a plain area located in rural households has experienced an overlapping incidence of poverty (H=78.5%) with a total of 32.9% contribution to the total incidence of poverty at the woreda level. Thus, as a policy direction emphasis has to be given to rural households located in the coastal areas.

Besides, looking into (Table 6), it is found that out of the total 153 rural households located in highland area 109 (71.2%) of them were MPI severely poor and 26 (16.99%) MPI poor, 18(11.76%) MPI vulnerable and none of them are MPI non-poor. Out of the total 130 rural households located in the plain area, 88 (67.7%) of them were MPI severely poor, 18(13.8%) of them are MPI poor, 24(18.5%) of them were MPI vulnerable and none of them are MPI non-poor. Similarly, out of the total 104 rural households located in the coastal area 80 (76.9%) of them were MPI severely poor, 11 (10.6%) of them were MPI poor, 12 (11.5%) of them are MPI vulnerable and only 1(.96%) of them were MPI non-poor. Furthermore, analysis of one-way ANOVA was performed between the dependent variable (deprivation score) and independent variable (farming system). First, to see whether the data meets or fails to meet the assumptions of one-way ANOVA (no significant outliers assumption, normality assumption, and homogeneity of variances assumption) (Lund Research Ltd, 2018) a test is made. Concerning no significant outliers assumption, it was revealed that no significant outliers (Fig. 6). It implies that there are no detected possible potential outliers in the dataset that reduce the accuracy of the result and hence the data met the assumption of one-way ANOVA.

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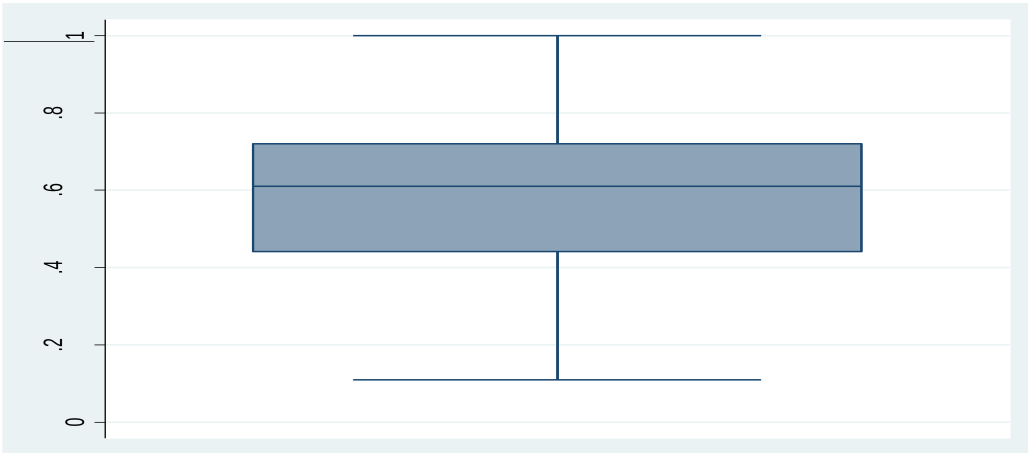
Fig 6: Test of no significant outliers assumption of one-way ANOVA



Source: Computed from field survey (2019)

Normality assumption is the second assumption of one-way ANOVA. According to Lund Research Ltd (2018), the dependent variable should be approximately normally distributed for each category of the independent variable. The normality assumption is done using the "Shapiro-Wilk test of normality" (Lund Research Ltd., 2018) using STATA. Presented in Table 7, the results of the Shapiro-Wilk test of normality for one-way ANOVA revealed that there is an insignificant difference between groups (p=0.09925>0.05) and hence normality assumption is met.

Table 7: Shapiro-Wilk test of normality assumption of one-way ANOVA for independent variable farming system and dependent variable deprivation score

by s2_q7, sort:swilk ds					
Shapiro	Obs	Wilk W test	for normal	data	Prob>z
Variables[3]		W	V	z	
s2_q7 = Highland ds	153	0.98511	1.762	1.286	0.09925
s2_q7 = Plain area ds	130	0.9687	3.223	2.633	0.00423
s2_q7 = Coastal area ds	104	0.97363	2.25	1.802	0.03574

Source: Computed from own field survey (2019)

The third assumption of one-way ANOVA tested is its homogeneity of variances. Using Bartlett's test for equal variances (P=0.362>0.05), the homogeneity assumption is also met because of the expected insignificant p-value.

[3] **Variables: Independent variables** *are highland, plain and coastal areas; however,* **dependent variable** *was deprivation score code as (ds).*

Table 8: Bartlett's test for equal variances assumption of one-way ANOVA for the independent variable farming system of the households and dependent variable deprivation score

Farming system	Summary of Deprivation score				
	Mean	Std. Dev.	Freq.		
Highland area	.59457571	.17674687	153		
Plain area	.58715385	.19676151	150		
Coastal area	.62759616	.19628835	104		
Total	.60095607	.18918934	387		
	Analysis of Variance				
Source	**SS**	**df**	**MS**	**F**	**Prob > F**
Between groups	.104802903	2	.052401452	1.47	0.2318
Within groups	13.7111429	384	.035706101		
Total	13.8159458	386	.035792606		
Bartlett's test for equal variances: chi2(2) = 2.0313 Prob>chi2 = 0.362					

Source: Computed from field survey (2019)

Once the three assumptions of one-way ANOA are tested and met, the analysis was made between the deprivation score of households and farming systems. Table 9, above result, revealed that there is no statistically significant difference (at 5% level) among farming systems of household heads in terms of their multidimensional poverty status as determined by one-way ANOVA (F (2,386) = 1.47, p = 0.2318>0.005). This implies that the multidimensional poverty status of households is more or less in the three farming systems.

C/. Decomposition by kebele of sample heads

Distribution of MPI indices and kebeles

Using availability sampling techniques, all the rural twelve kebeles were sampled in this study. To see the distribution of poverty in the current study area by respective kebele, the researcher produced STATA results. Results show that out of the twelve sampled kebeles no any rural kebele of the study area with sample heads lived MPI non-poor. All of them were found MPI poor. But when decomposed only Charo Gobeno kebele (localed in plain area) found MPI vulnerable. This is so because the kebele is very close (adjacent to Hareto town) and sample heads get easy access to development interventions. For examples, in the kebele ECCE[4] school was constructed by Generation in Action Development Association in 2009. The kebele also get accessed to quality school constructed by hallow concrete blocks which is very difficult to find such kind of school in other kebeles. Sample heads around "Tusha" area also accessed to another primary school. Furthermore, the kebele previllaged access to spring

[4] **ECCE school:** *early childhood care and development refers pre-school service program for chilcern aged less than school-age of the country*

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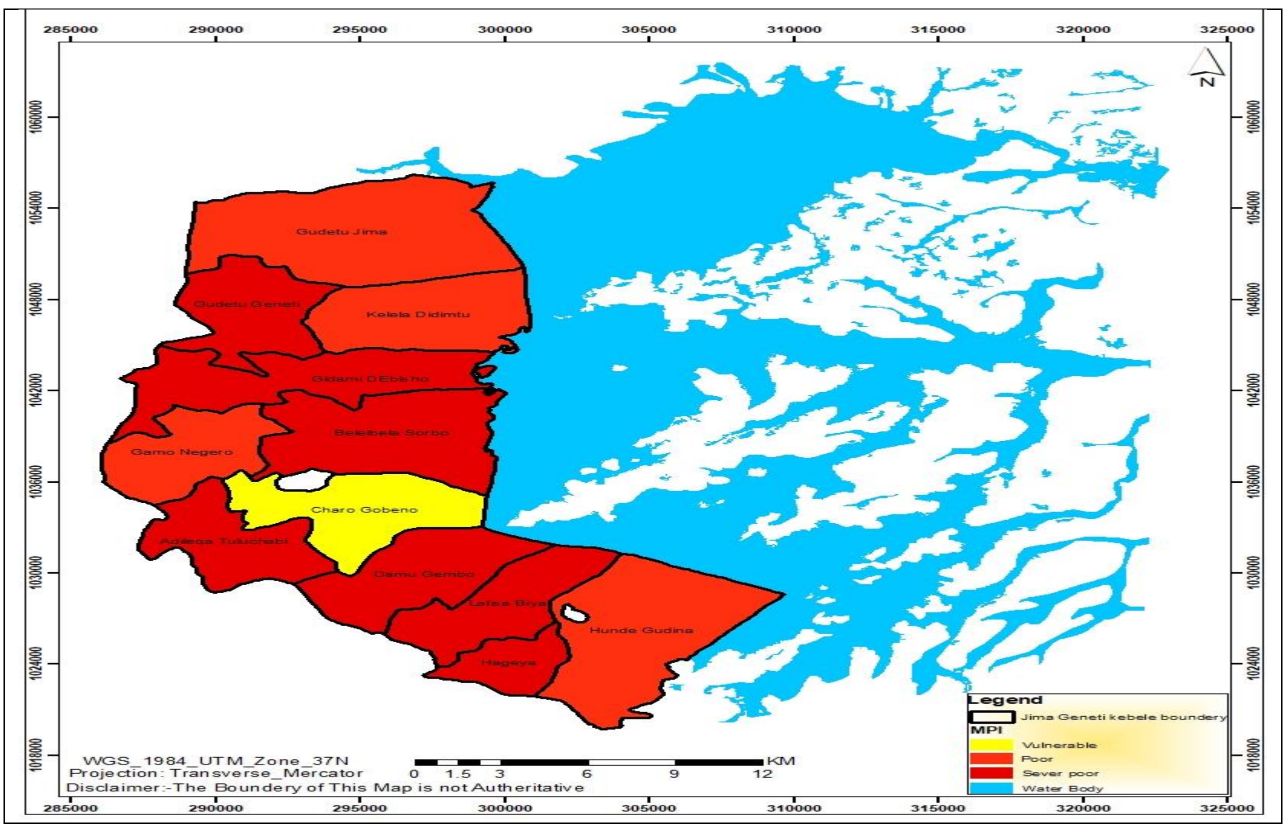
developments like "Bure" spring. Hand-pump water schemes are also available in most part of the kebele. Health post is available in the kebele aroung "Gefere" area.

Farmers Training Center is also there. However, the remaining 4 (33.33%) sample kebeles (Gudetu Jimma, Kalala Didimtu, Gamo Negero, and Hunde Gudina kebeles) found MPI poor and 7 (58.33%) sample kebeles like Gudetu Geneti, Gidami Dabsho, Balbala Sorgo, Adi Leke Tulu Chali, Damu Genbo, Lalisa Biya and Hagaya kebeles found MPI sever poor. With respect to sample kebeles with highest multidimensional poverty index, results show that the first four sample kebeles include: Incidence of poverty (H): 1st Balbala Sorgo kebele (93.5%), 2nd, Damu Genbo kebele (89.5%), 3rd, Hagaya kebele (82.4%) and 4th, Gudetu Geneti (81.3%), Intensity of poverty (A): 1st Balbala Sorgo kebele (78.6%), 2nd, Hagaya kebele (76.1%), 3rd, Adi l Leka Tulu Chali kebele (75.6%) and 4th ,Gudetu Geneti (66.4%), and Aggregate poverty index (M_0):1st Balbala Sorgo kebele (73.5%), 2nd, Damu Genebo Kebele (66.4%), 3rd, Hagaya kebele (62.7%) and 4th, Adi leka Tulu Chali (61.8%). The overall aggregate poverty indexes imply that rural poverty reduction strategies should give due emphasis (Fig 7).

Fig 7: Distribution of the multidimensional poverty index of the study area by kebele



Source: Ethiopia Mapping Agency, expert assisted map (2021)
1st, Balbala Sorgo kebele

This kebele is highly characterized by swampy areas in the woreda in the kebele, rural heads located on the mainland, and the "*Chittu*[5]" island of Balabala Sorgo kebele have been found affected by the rise of the level of Fincha'a Lake. The result of the incidence of poverty of the kebele was found as 93.5%, contributed 9.4%, and first-ranked high prevalence. The population share of the kebele was found as 8%. While the absolute intensity of poverty Balabala Sorgo kebele was found as 78.6% (contributed, 118%), its aggregate MPI was 73.5%, contributed 11.1%. Besides, in Balbala Sorgo kebele, when MPI is decomposed by different poverty categories, it was found that out of the total sample households (31/0.080%), 27 sample heads, MPI severely poor, 2 sample heads each MPI poor and MPI vulnerable, respectively and no household was found MPI non-poor in Balbala Sorgo Kebele implying that MPI indices were widespread in the kebele when compared to the remaining sample kebeles of the study area. The major reason is that in Balbala Sorgo kebele there have been serious livelihoods depletions due to Fincha'a Lake. For example, loss of animals, humans, and crops losses due to flood and overflow of the Lake. This could be further evidenced by the special support and basic service deliveries given by local non-governmental organizations like Education for Development Association, the generation in Action Development Association, an international NGO (World Vision- Ethiopia) to the poor heads living the kebele. Hence, development intervention (hydroelectric dam construction) shouldn't have any environmental impact and above all shouldn't disrupt the livelihood sources of the nearby rural households. It has to encompass the meanings of sustainable rural development. Re-locating sample heads living on "*Chittu*" island demand urgent re-location on the mainland in kebele.

2nd, Damu Genbo kebele

Damu Genbo kebele is located after Charo Gobeno kebele on the way to Kidame Gebeya town. In terms of farming systems, the kebele is characterized by both farming systems (high land, plain area, and coastal areas). Telephone interview with Fituma Chimdessa and Asfaw Mitiku (20/01/2020) revealed that Damu Genbo kebele is known for its capital town of Wollega "Kifle Hager[6]" during the imperial period of Ethiopia. Oromo, Amhara, Walayita, Sidama, Gumuz, Kefa, and other nations and nationalities have been living in the kebele. Results show the number of deprived rural households (89.5%, contributing 5.5%), the intensity of poverty (7.4%, contribute 111%), and adjusted headcount ratio (66.4%), second-ranked next to Balbala Sorgo kebele. Besides, in Damu Genbo kebele, when MPI is decomposed by different poverty categories, it was found that out of the total sample households (19/0.049%) 16 households were MPI severely poor, 2 households were found MPI poor, 1 household was MPI vulnerable, and no household was found MPI non-poor in the kebele. There are several reasons.

For example, Damu Genbo kebele sample heads lack quality education and health services. No rural electric supply and potable water supply services in the kebele. Sample heads get access to dirty water sources from the running "*Laga Gida*"[7]. As the kebele is dominated by high land area, only a few rural households located in the plain area and coastal area have access to a very small plot of traditional irrigation. A very small portion of the kebele (Kara area) has access to a very short kilometer asphalt road from Shambu to Bako towns. The environmental destruction on Jaldesa Mountian could perpetuate

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[5] **Chittu:** Island detached from mainland and engulfed by water body (*see*, both refered mentioned maps).
[6] **Kifle Hager:** *is the higher administrative unit that constitutes some woredas. Re-named as Zone.*
[7] **Laga Gida:** *Laga is Oromo language. Laga Gida means, Gida river*

the current high prevalence of poverty in the kebele. These imply that to reduce the MPI status of Damu Genbo kebele and its prevalence of poverty (H), priority numbers have to be given.

3rd, Hagaya kebele

Hagaya Kebele is also found in a remote area from Hareto town (capital town of the study woreda). When one moves to Kidame Gebeya or Wayu town of Jimma rare woreda, Hagaya kebele is located after Lalisa Biya kebele, at a very short distance from Kidame Gebeya. As indicated in Table 5.7, below, the population share, prevalence of poverty, intensity of poverty and composite MPI of Haga kebele was as 4.4%, 82.4% (contribution 4.5%), 76.1% (contribution 116%), and 62.7% (contribution 5.2%), respectively. Besides, it was found that out of the total sample households (17/0.044%) from the kebele, 14 households were MPI severely poor, no household was found MPI poor, 3 households were MPI vulnerable, and no household was found MPI non-poor in the kebele. The potential reason may include proximity of the kebele to get quality education and health services and poor living standards. Thus, the kebele also needs priority interventions.

4th, Adi Leka Tulu Chali kebele

Adi Leka Tulu Chali kebele is located in the high altitude area of the woreda. Mountian Chali is found in this kebele. It has a total population share of 8.5%. When MPI indices of the study area decomposed, results show the incidence of poverty (81.8%, 8.7% contribution), the intensity of poverty (75.6%, 114% contribution), and aggregate poverty (61.8%). Besides, the kebele was found characterized by 30 households MPI severely poor, 3 households MPI vulnerable, and no household was found no household MPI poor and non-poor in the Kebele.

Several potential reseasons exist for which lack of access road. The rural road constructed in the kebele was found difficult to access the kebele for the provisions of basic services like education, health, and improve living standards of the sample heads. Most of the access rural road in the kebele was eroded. Most of the children in the kebele either have been renting houses in Hareto town or find a relative close to Hareto town for their education. Recently, Oromia Development Association (ODA) has constructed a primary school in the kebele. No, any health institution is found in the kebele. Access to potable water was absent. Living standard parameters, for example, electricity, modern cooking fuel, housing, and others are at low status. This implies that the kebele has to be among the top prioritized kebeles in multidimensional poverty reduction efforts in the study area.

Investigations of statistically significant differences

To see whether there is a statistical significance difference between different kebeles of the household heads, tests of normality assumption and homogeneity assumption were made. Shapiro-Wilk test of normality result revealed that there was insignificant difference between groups, i.e, i.e, normal distribution of dependent variable for Gudetu Jimma, Kalala Didimtu, Gudetu Geneti, Gidami Dabsho, Gamo Negero, Charo Gobeno, and Damu Genebo kebeles (each p-value>0.05) and hence normality assumption was met for seven kebeles. However, normality assumption was failed (i.e, skewed) for sample kebeles like Balbala sorgo (p=0000<0.005), Adi Leka Tulu Chali (p=0.04044<0.05), Lalisa Biya

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(p=0.00573<0.05), and Hagaya kebeles (p=0.04632<0.05) but tolerable. The other assumption of one-way ANOVA tested was its homogeneity of variances. STATA produces the results of Table 9, below. Bartlett's test for equal variances, insignificant P-value =0.815>0.05) implying that normality assumption for households deprivation score by kebele was met. Once the three assumptions of one-way ANOVA were tested and valid, the researcher run the STATA one way-ANOVA test of significance of deprivation score of households of the study area by independent variable kebele. Looking at Table 5.8, above, participants were classified into twelve groups: Gudetu Jimma (n1=46), Kalala Didimtu (n2=29), Gudetu Geenti (n3=32), Gidami Dabsho (n4=34), BalbalaSorgo (n5=31), Gamo Negero (n6=28), Adi Leka Tulu Chala (n7=33), Charo Gobeno (n8=30), Lalisa Biya (n9=19), Hagaya (n10=17) and Hunde Gudina kebele (n12=55), no missing value observed. Result revealed that there is a statistically significant difference (at 5% level) among kebeles of household heads in terms of their multidimensional poverty status as determined by one-way ANOVA (F (11,375) = 7.03, p = 0.0000<0.05)(Table 5.12, above), post hoc comparisons located where the difference lie (Appendix 3). It depicts post-hoc analysis shows post-hoc pairwise comparisons among 66 comparison groups. Results of the Sadik post-hoc test [more moderate test] revealed that multidimensional poverty was statistically significant between 13 comparisons out of 66 comparisons such as between Balbala Sorgo vs Gudetu Jimma (0.2295 ± 0.0406 kebeles, p = .000<0.05), Adi Leka Tulu Chali vs Gudetu Jimma(0.1669 ± 0.3987 kebeles, p = .002<0.05), Balbala Sorgo vs Gudetu Jimma (0.2295 ± 0.0406 kebeles, p = .001<0.05), Damu Genbo vs Gudetu Jimma (0.1780 ± 0.0476 kebeles, p = .014<0.05), Balbala Sorgo vs Kalala Didimtu (0.2243 ± 0.0451 kebeles, p = .000<0.05), Adi Leka Tulu Chali vs Kalala Didimtu (0.1617 ± 0.0444 kebeles, p = .021<0.05) groups. However, there were no statistically significant differences between the remaining 53 comparison groups.

Table 9: Barrtlett's test of Homogeneity assumption for one-way ANOVA of deprivation score of households by kebele (N=387)

Kebeles	Summary of Deprivation score		
	Mean	Std. Dev.	Freq.
Gudetu Jimma	.52304348	.16717083	46
Kalala Didimtu	.52827587	.19359511	29
Gudetu Geneti	.6234375	.154076	32
Gidami Dabsho	.585	.16053414	34
Balbala Sorgo	.75258064	.18818373	31
Gamo Negero	.56071429	.17266813	28
Adi Leka Tulu Chali	.69	.17865819	33
Charo Gobeno	.47066667	.1737603	30
Damu Genbo	.70105262	.19980253	19
Lalisa Biya	.63272728	.18666937	33
Hagaya	.68294118	.21212509	17
Hunde Gudina	.5749091	.1517292	55
Total	.60095607	.18918934	387
	Analysis of Variance		

Source	SS	df	MS	F	Prob > F
Between groups	2.36145961	11	.214678146	7.03	0.0000
Within groups	11.4544862	375	.030545296		
Total	13.8159458	386	.035792606		
Bartlett's test for equal variances: chi2(11) = 6.7953 Prob>chi2 = 0.815					

Source: Computed from own field survey (2019)

Overall, the decomposition of MPI by sample heads, farming systems, and kebeles allows this study to identify the poorest areas and see to what extent people in these areas are being left behind in the multidimensional poverty index. All decomposed results call for policy planning to more precisely target areas most in need with high MPI value, for examples, in terms of farming system 1st coastal area (57.4%), 2nd plain area (51..8%) and followed by high land area (51.3%). In terms of sample heads kebele,1st Balbala Sorgo (**73.5%),** 2nd, Damu Genebo (66.4%), 3rd, Hagaya (62.7%), and 4th, Adi Leka Tulu Chali (61.8%) kebeles should be targeted. In response to the drivers of sample heads to be into or out of multidimensional poverty, section 5.3.5 presented results and discussed.

Determinants of households' multidimensional poverty

In the descriptive analysis, MPI indices results show that the incidence of poverty was 80.1%, the intensity of poverty (A) is 66.35% and the adjusted headcount ratio (M0) is 53.1%. When decomposed into different poverty categories it is found that out of the total 387 sample households, majority of them 277/71.58%) sample households from the study area are MPI severely poor, 55(14.21%) MPI poor, 54 (13.95%) MPI vulnerable and only 1 (0.26%) household is MPI non-poor. Therefore, to investigate significant determinants of rural households' multidimensional poverty, econometric analysis using the ordered logit (ologit) model is made. However, before performing ologit model analysis, screening risk factor or diagnosis test of the assumption ordered logit model (no multicollinearity) is made first. Once no multicollinearity assumption is met, an analysis of the determinants of multidimensional poverty of households is made.

Diagnosis Test of the model assumption: There were two separate tests of the multicollinearity assumption of ologit model. First, diagnosis test of multicollinearity assumption for fifteen discrete variables using pairwise correlation STATA command. With discrete explanatory variables, multicollinearity occurs when discrete independent variables in a regression model are correlated. In a diagnostic test of discrete explanatory multicollinearity problem, discrete independent variables should be independent, not correlated; otherwise, if multicollinearity exists the precision of the estimate of coefficients could weaken the statistical power of the ordered logit model. Thus, to verify that the data meet the no multicollinearity basic assumption of the ordered logit model and the result is presented in (Appandix2). It examined bivariate relationships between fifteen different discrete independent variables. Coefficients of contingency [chi-square /c^2 based measure of association] range between 0

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and 1 where a value close to 1 indicates the presence of strong association/serious multicollinearity (Healy, 1984; Yizengaw *et al*., 2015). If Table 7 verify the degree of associations among dummy explanatory variables (greater than 0.75), the parameter estimate would seriously be affected by the presence of multicollinearity among variables. However, in the case of the current study, there was no value 0.75 or above that which indicates that no strong relationship exists between dummy or explanatory variables and, therefore no serious multicollinearity problem. The second diagnosis test of multicollinearity assumptions is done for five continuous variables using the Variance Inflation Factor (VIF) (Table 10).

Table 10: Results of screening risk factors (diagnosis tests) of ologit assumption (no multicollinearity)

Variables	VIF	Tolerance=1/VIF
Farm size (Hect)	1.12	0.892144
Livestock (TLU)	1.11	0.896997
Age	1.11	0.898460
Family size	1.07	0.930912
Dependency ratio	1.03	0.971327
Mean VIF	1.09	

Source: Computed from field survey (2019)

According to Pennsylvania State University (2020), a VIF of 1 means no correlation among predictors: no inflated at all, VIF exceeding 4 warrants further investigation, and VIF exceeding 10 are signs of serious multicollinearity requiring correction. Thus, with mean VIF the estimated values of VIF revealed no multicollinearity ("rule of thumb" of VIF<10 in each predicator variables) showing that the assumption of the ordered logit model was met and possible to trust coefficients and P-value in the analysis of the determinants of multidimensional poverty of the current study.

Determinants of rural households' multidimensional poverty: A determinant of multidimensional poverty refers to its proximate causes (Haughton & Khandker, 2009). The study tested and confirmed that no multicollinearity problem with ordinal data. The study wants to investigate the statistically significant causes of sample households being multidimensional poor. The study identified dependent variable (poverty categories: deprivation cut-off score (K) less than 0.2% identified as MPI non-poor, 0.2<K<0.333% MPI vulnerable, 0.333<K<0.50 as MPI poor and greater than or equal to 1/2 (50%) sever MPI poor (Alkire & Jahan, 2018).) and twenty different explanatory variables and inserted in the model. Significant results of the ordered logit model are shown in Table 11.

Table 11: Results of the econometric ologit model

Significant variables (Xs) (A)	Coefficients (B)			Odds ratios (C)		Marginal effects(D)	
	βs	**Std. Err.**	**p>/z/**	**or**	**p>/z/**	**dy/dx**	**p>/z/**
Agro-ecology/farming system	-.7473385	.3839514	0.052	.4736255	0.052	.0910019	0.040
Place of residence/kebele [1]	-0.2820006	.0901174	**0.002**	0.7542732	0.002	0.03433387	0.000
Sex of HH head	-.1076989	.8020386	0.893	.8978979	0.893	.0131143	0.893
Age of the HH head	-.5882251	.5784934	0.309	.555312	0.309	.071627	0.304
Family size of the HH head	-.3885906	.3449206	0.260	.6780118	0.260	.0473179	0.254
Marital status of HH head [3]	0.7524454	.2793369	**0.007**	2.122183	0.007	-0.0916238	0.003
Education level of HH head	.5779587	.4381775	0.187	1.782396	0.187	-.0703769	0.176
Literacy status of HH head [2]	-0.8986961	.3029484	**0.003**	0.4071001	0.003	0.1094324	0.001
Religion of the HH head	-.0872457	.1294163	0.500	.9164519	0.500	.0106237	0.498
Ethnicity of the HH head	-13.03462	3911.859	0.997	2.18e-06	0.997	1.5872	0.997
Dependency ratio	1.904517	1.338803	0.155	6.716161	0.155	-.2319092	0.145
Livestock holding (TLU)	.017913	.0507831	0.724	1.018074	0.724	-.0021812	0.724
Agricultural employ.t status	-16.12434	1715.921	0.993	9.94e-08	0.993	1.963428	0.993
Landholding (in hectare) [5]	0.3949135	.1680824	**0.035**	1.426057	0.035	-0.0432171	0.027
Access to remittance	.120613	.6673171	0.857	1.128188	0.857	-.0146868	0.856
Saving	-.3025048	.6545885	0.644	.7389649	0.644	.0368354	0.643
Access to credit	-.4558967	.5380377	0.397	.6338793	0.397	.0555136	0.392
Access to irrigation	.8305034	.7275302	0.254	2.294473	0.254	-.1011287	0.246
Membership in cooperatives[4]	-1.973214	.7784798	**0.011**	0.1390094	0.011	0.2402743	0.006
Access to agricul.l extension	-1.065823	.8657498	0.218	.3444443	0.218	.1297831	0.213
/cut1	-33.50834	4271.654		-33.50834			
/cut2	-31.88762	4271.654		-31.88762			
/cut3	-29.29321	4271.654		-29.29321			

Note: 1-5: significant variables from smallest p-value to biggest, show the most significant variables accordingly: the smallest the p-value, the most significant explanatory variable, i.e, to be most significant, the p-value has to be closer to zero
Source: Computed from own field survey (2019)

Looking at Table 11 /column B results of the estimation of the coefficients (bs) shows that five explanatory variables [kebele dummy, marital status, literacy status, landholding (in hectare), and being a member of cooperatives] were identified as statistically significant determinants of the probability of household heads] to be MPI poor (p-value<0.05). The detailed discussions and interpretations of the effects of these significant explanatory variables are made in the next paragraphs.

Place of residence/kebele (most significant): In the current study it was expected that high poverty status could be identified in resource-poor and fragile environment kebeles (swampy areas like *Balbala Sorgo kebele*) and hence Kebele of the sample households was found as one of the significant determinants of being MPI poor. Consistent with the hypothesis and previous findings such as Bogale *et al*. (2005), Bogale (2011), and Bahta & Haile (2013) result of the ordered logistic regression analysis revealed that kebele of the household heads has negatively (b=-.2820006) and significantly (p=0.002<0.05) influenced sample households being MPI poor, implying that the log of odds of being MPI poor decreases by 75.4%, other factors constant. The marginal effect .0343387 indicates that as variation in kebele of sample households increases by one more unit, the probability of being MPI poor decreases 3 times or by 3.4% at a 5% significance level. Households from *Balbala Sorgo* kebele live

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in the coastal area of *Fincha'a* artificial hydro-electric dam. Even some households from the kebele are living on the island known as "*Chittu*"[1] island. Most of their farmland has been covered by a swampy area. The water in search of green pasture has taken livestock away. Their livelihood sources have been depleting and forced them to be MPI poor.

Marital status of HH head: unlike non-marriage, marriage commitment or long-term marital relationship brings an array of benefits in a given rural household. For example, it generally adds a potential earner to the household by increasing the productivity and the efficiency of the household and also enhances the economic well-being/ wealth accumulation of members of the family, including the children. Married women living in male-headed households have the prospect of enjoying larger family income because these families have a larger number of earning members and especially a larger number of earning male members; monogamous marriage[has the largest probability of reducing poverty], divorce/separation, and widowhood are negatively and significantly correlated with the probability of being poor in Nigeria (Anyanwu, 2014), show that increase in income of couples' reduces household level poverty. Results of the currently ordered logistic regression model revealed that the marital status of the household heads has positively (b=.7524454) and significantly (p=0.007<0.05) influenced households being MPI poor, implying that the log of odds of being MPI poor increases by 12.2%, other factors constant. The marginal effect -.0916238 indicates that being an unmarried household head increases the probability of being MPI poor by 9.2% which is statistically significant at 5%. The potential reasons could be couples' specialization in specific skills and duties could enable them to produce larger outputs, their joint life may encourage couples' to construct a house, buy oxen and agricultural tools, save for children's education by minimizing combined expenditures, and acquire other assets. Besides, marriage expands one's social network and social support, which often results in additional opportunities and benefits that lead to saving, implying that marriage has a large effect on reducing the risk of rural poverty.

Literacy status of HH head: Consistent with the findings of Bruck & Sindu (2013) and Alemeseged (2016), the current result of the ordered logistic regression model of the current study revealed that the literacy status of the household heads has negatively (b=-.8986961) and significantly (p=0.003<0.05) influenced households being MPI poor. Other things being constant, the log of odds of being MPI poor decreases by 40.7%, as the literacy level is improved. The marginal effect .1094324 indicates that as the literacy status of household heads increases by one more unit, the probability of being MPI poor decreases by 10.9% which is statistically significant at 5%.

Landholding (in hectare): Increase in land ownership was found to reduce poverty; it helps the households cultivate more food for market purposes (Amao *et al*., 2017). Thus, it was expected that the landholding of sample households reduces their probability of being MPI poor. Thus, as expected results of the ordered logit model revealed that the landholding size of the sample households was found statistically significant determinant of the probability of being MPI poor (P=035>0.05), implying that the log of the odds of being multidimensional poor decreases with the increases in households size of landing holding in a hectare, *ceteris paribus* by 42.6%. The marginal effect -.0432171 indicates that as the probability of the landholding size in a hectare of heads increases by one more unit, the probability of being MPI poor decreases by 4.3%. This result is consistent with the findings of several scholars (Bogale *et al*.2005; Bahta & Haile, 2013; Alemeseged, 2016; Desawi, 2019).

Membership in cooperatives: The study expected that households being a member of cooperatives significantly reduce their chance of being MPI poor. Consistent with this presumption and previous findings like Bogale (2011) results of the ordered logit model revealed that household heads being a member of cooperatives revealed negatively (b=-1.973214) and statistically significant determinants of the probability of being MPI poor (P=0.218>0.05), implying that the log of the odds of being multidimensional poor decreases with the increases in households being a member of cooperatives *ceteris paribus* by 13.9%. The marginal effect .24027743 indicates that as the probability of heads becoming a member of cooperatives increases by one more unit, the probability of being MPI poor decreases by 24%.

4. Conclusion & policy implications

Results of the descriptive analysis show that the incidence of poverty status of the sample respondents is 80.1% (MPI poor); the intensity of poverty is 66.3% and the adjusted headcount ratio is 53.1%. Dimensionally, the living standard dimension is the highest contributor to the overall MPI of the sample households (42.5%) followed by the education dimension (36.7%) and health dimension (20.9%). The coastal area has contributed a total of 28.1% to the overall 80.1% of the incidence of poverty. Furthermore, results of the regression analysis indicated that kebele dummy, marital status, literacy status, farm size, and membership to cooperatives of households are found significant determinants of households being MPI poor. Therefore, it is possible to conclude that the status of multidimensional poverty is widespread in the current study area. Multiple factors are causes. Thus, to reduce multidimensional poverty, policy implications that give top priority to living standard dimensions followed by education and health dimension should be in place. A policy in favor of sample households from coastal areas required. Furthermore, a rural multidimensional poverty reduction strategy that considers the effect of rural households' determinant variables kebele dummy, marital status, literacy status, farm size, and membership to cooperatives of household heads should be designed.

In a monetary approach to poverty study, it is income/consumption expenditures that have been used to assess the poverty status of a given household. Despite its significances, such an approach has been criticized being it doesn't capture a comprehensive picture of rural households' poverty. The interest in the multidimensional approach has been growing. In multidimensional poverty analysis, multiple indicators that could help to capture a comprehensive picture of rural households' poverty are. Some multidimensional poverty researchers used binary logistic regression models. Categorizing households as either MPI poor or MPI non-poor alone was insufficient to effectively design rural households' poverty reduction. Circumvent further decomposition of MPI poor households into different poverty categories (MPI severely poor, MPI poor, MPI vulnerable, and MPI non-poor) becomes an issue that shouldn't. It is ordered categories of rural multidimensional poverty decomposition. Ordinal Logistic regression is applied for analysis. Therefore, it is possible to conclude that because uni-dimensional poverty study couldn't capture a comprehensive picture of households poverty, this study further re-affirmed the significances of the multidimensional poverty approach alongside with monetary approach.

An ordered logit regression model could be used in this case in combination studies with a binary regression model.

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Appendix1: The censored proportion of households deprived and disaggregated MPI poor in each indicator (N=387)

Dimension	**MPI indicator**	**Censored headcount ratio (H)**				
		Deprived		**MPI poor disaggregated**		
		N	**%**	**Poverty categories**	**N**	**%**
Health	Nutrition adult indicator	162	41.9	MPI severely poor (K>0.50)	138	85.19
				MPI poor (0.3663<K<0.50)	7	4.32
				MPI vulnerable (0.20<K<0.3663)	17	10.49
	Nutrition child indicator	190	49.1	MPI severely poor (K>0.50)	171	90.00
				MPI poor (0.3663<K<0.50)	18	9.47
				MPI vulnerable (0.20<K<0.3663)	1	0.53
	Child mortality indicator	43	11.1	MPI severely poor (K>0.50)	39	90.70
				MPI poor (0.3663<K<0.50)	3	6.98
				MPI severely poor (K>0.50)	1	2.33
Education	Years of schooling indicator	208	53.7	MPI poor (0.3663<K<0.50)	202	97.12
				MPI vulnerable (0.20<K<0.3663)	5	2.40
				MPI severely poor (K>0.50)	1	0.48
	School attendance indicator	246	63.6	MPI poor (0.3663<K<0.50)	221	89.84
				MPI vulnerable (0.20<K<0.3663)	24	9.76
				MPI severely poor (K>0.50)	1	0.41
Living standard	Cooking fuel indicator	355	91.7	MPI poor (0.3663<K<0.50)	250	70.42
				MPI vulnerable (0.20<K<0.3663)	53	14.93
				MPI severely poor (K>0.50)	52	14.65
	Sanitation indicator	269	69.5	MPI severely poor (K>0.50)	191	71.0
				MPI poor (0.3663<K<0.50)	43	15.99

Dimension	**MPI indicator**	**Censored headcount ratio (H)**				
		Deprived		**MPI poor disaggregated**		
		N	**%**	**Poverty categories**	**N**	**%**
				MPI vulnerable (0.20<K<0.3663)	35	13.01
	Drinking water indicator	306	79.07	MPI severely poor (K>0.50)	220	71.90
				MPI poor (0.3663<K<0.50)	43	14.05
				MPI vulnerable (0.20<K<0.3663)	43	14.05
	Electricity indicator	349	90.18	MPI severely poor (K>0.50)	244	69.91
				MPI poor (0.3663<K<0.50)	53	19.19
				MPI vulnerable (0.20<K<0.3663)	51	14.61
				MPI non-poor (K<0.20)	1	0.29
	Housing indicator	257	66.4	MPI poor (0.3663<K<0.50)	190	73.93
				MPI vulnerable (0.20<K<0.3663)	27	10.51
				MPI severely poor (K>0.50)	40	15.56
	Asset indicator	301	77.8	MPI severely poor (K>0.50)	213	70.76
				MPI poor (0.3663<K<0.50)	44	14.62
				MPI vulnerable (0.20<K<0.3663)	43	14.29
				MPI non-poor (K<0.20)	1	0.33

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Appendix2: Contingency coefficients of categorical independent variables

Variable	s2_q7	s2_q8	s3_q12	s3_q15	Education	s3_q17	s3_q18	s3_q19	s4_q72	s4_q84	s4_q69	s4_q141_7	s4_q141_8	s4_q62	s4_q133
s2_q7	1.0000														
s2_q8	-0.1290	1.0000													
s3_q12	0.0315	0.0640	1.0000												
s3_q15	-0.0189	0.2052	-0.0693	1.0000											
Education	0.0487	0.0057	0.1665	-0.0548	1.0000										
s3_q17	0.0918	-0.2375	-0.1155	-0.1197	0.0435	1.0000									
s3_q18	-0.0156	-0.0154	0.0811	-0.1108	-0.0469	-0.1084	1.0000								
s3_q19	0.0489	0.0961	0.0426	0.1057	-0.0316	-0.0064	-0.1047	1.0000							
s4_q72	-0.0560	0.0872	-0.0431	0.0163	-0.0799	-0.0558	0.1212	0.0634	1.0000						

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s4_q84	-0.0495	-0.0612	-0.1320	-0.0087	0.0394	0.0968	-0.0111	-0.0438	-0.0303	1.0000					
s4_q69	0.0791	-0.2913	0.0356	0.0911	0.1590	0.1877	-0.0308	0.0449	-0.2093	-0.1018	1.0000				
s4_q141_7	0.1512	0.0292	0.0420	0.1266	0.1272	-0.1036	-0.1163	0.1070	-0.0610	-0.0318	0.1092	1.0000			
s4_q141_8	0.2692	-0.2795	-0.0014	0.1156	0.0966	0.0914	-0.1275	0.0552	-0.1734	0.0233	0.2513	0.3442	1.0000		
s4_q62	0.0371	-0.3251	0.0317	0.0202	0.1315	0.2056	-0.0361	0.0117	-0.1892	-0.0263	0.3473	0.0641	0.3210	1.0000	
s4_q133	-0.3174	0.3075	-0.0072	-0.0574	-0.1158	-0.1891	0.1951	-0.0262	0.1891	-0.0035	-0.2811	-0.2102	-0.5885	-0.2562	1.0000

Source: Computed from own field survey (2019)
Keynotes:

Agro-ecology/farming system (s2-q7) Place of residence/kebele (s2-q8) Sex of HH head (s3-q12) Marital status of HH head (s3-q15)	Education Literacy status of HH head (s3-q17) The religion of the HH head (s3-q18) The ethnicity of the HH head (s3-q19)	Agricultural employment status (s4-q72) Access to remittance (s4-q84) Saving (s4-q69) Access to credit (s4-q141_7)	Access to irrigation (s4-q141_8) Membership in cooperatives(s4-q62) Access to agricultural extension(s4-q133)

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Appendix 3: SADIK POST-HOC PAIREWISE COMPARISON TEST WITH EQUAL VARIANCE
(pwmean ds,over(s2_q8) mcompare (sid) effects)

ds	Contrast	Std. Err.	Sidak t	Sidak P>|t|	Sidak [95% Conf.	Interval]
s2_q8						
Kulala Diddimtu vs Gudina Jimaa	.0052324	.0414405	0.13	1.000	-.1351955	.1456602
G/ Gaanetii vs Gudina Jimaa	.100394	.0402314	2.50	0.579	-.0359368	.2367248
G/ Dabsho vs Gudina Jimaa	.0619565	.0395274	1.57	1.000	-.0719887	.1959017
Balbalaa Soorgo vs Gudina Jimaa	.2295372	.0406123	5.65	0.000	.0919157	.3671586
Gamoo Niggaro vs Gudina Jimaa	.0376708	.0418919	0.90	1.000	-.1042867	.1796283
Adii leka Tullu Chalii vs Gudina Jimaa	.1669565	.0398703	4.19	0.002	.0318494	.3020636
Charo Gaabanoo vs Gudina Jimaa	-.0523768	.0410147	-1.28	1.000	-.1913618	.0866081
Damuu Geembo vs Gudina Jimaa	.1780091	.0476621	3.73	0.014	.0164984	.3395199
Lelisa Biyya vs Gudina Jimaa	.1096838	.0398703	2.75	0.338	-.0254233	.2447909
Hagayyaa vs Gudina Jimaa	.1598977	.0496066	3.22	0.087	-.0082022	.3279976
Hunde Guddinaa vs Gudina Jimaa	.0518656	.0349199	1.49	1.000	-.066466	.1701973
G/ Gaanetii vs Kulala Diddimtu	.0951616	.0448088	2.12	0.900	-.0566802	.2470035
G/ Dabsho vs Kulala Diddimtu	.0567241	.0441778	1.28	1.000	-.0929795	.2064278
Balbalaa Soorgo vs Kulala Diddimtu	.2243048	.0451511	4.97	0.000	.0713031	.3773065
Gamoo Niggaro vs Kulala Diddimtu	.0324384	.0463054	0.70	1.000	-.1244749	.1893518
Adii leka Tullu Chalii vs Kulala Diddimtu	.1617241	.0444848	3.64	0.021	.01098	.3124683
Charo Gaabanoo vs Kulala Diddimtu	-.0576092	.0455133	-1.27	1.000	-.2118385	.0966201
Damuu Geembo vs Kulala Diddimtu	.1727768	.0515842	3.35	0.057	-.0020248	.3475783
Lelisa Biyya vs Kulala Diddimtu	.1044514	.0444848	2.35	0.725	-.0462927	.2551955
Hagayyaa vs Kulala Diddimtu	.1546653	.053386	2.90	0.232	-.0262419	.3355726
Hunde Guddinaa vs Kulala Diddimtu	.0466332	.040108	1.16	1.000	-.0892794	.1825459
G/ Dabsho vs G/ Gaanetii	-.0384375	.0430457	-0.89	1.000	-.1843048	.1074298
Balbalaa Soorgo vs G/ Gaanetii	.1291431	.044044	2.93	0.210	-.0201071	.2783933
Gamoo Niggaro vs G/ Gaanetii	-.0627232	.0452266	-1.39	1.000	-.2159809	.0905344
Adii leka Tullu Chalii vs G/ Gaanetii	.0665625	.0433608	1.54	1.000	-.0803725	.2134975
Charo Gaabanoo vs G/ Gaanetii	-.1527708	.0444153	-3.44	0.042	-.3032792	-.0022624
Damuu Geembo vs G/ Gaanetii	.0776151	.0506181	1.53	1.000	-.0939124	.2491426
Lelisa Biyya vs G/ Gaanetii	.0092898	.0433608	0.21	1.000	-.1376452	.1562248
Hagayyaa vs G/ Gaanetii	.0595037	.0524531	1.13	1.000	-.118242	.2372494
Hunde Guddinaa vs G/ Gaanetii	-.0485284	.0388576	-1.25	1.000	-.1802035	.0831467
Balbalaa Soorgo vs G/ Dabsho	.1675806	.0434019	3.86	0.009	.0205063	.314655
Gamoo Niggaro vs G/ Dabsho	-.0242857	.0446015	-0.54	1.000	-.1754252	.1268538
Adii leka Tullu Chalii vs G/ Dabsho	.105	.0427084	2.46	0.616	-.0397243	.2497243
Charo Gaabanoo vs G/ Dabsho	-.1143333	.0437786	-2.61	0.463	-.2626843	.0340176
Damuu Geembo vs G/ Dabsho	.1160526	.0500603	2.32	0.753	-.053585	.2856902
Lelisa Biyya vs G/ Dabsho	.0477273	.0427084	1.12	1.000	-.096997	.1924516
Hagayyaa vs G/ Dabsho	.0979412	.0519151	1.89	0.983	-.0779814	.2738638
Hunde Guddinaa vs G/ Dabsho	-.0100909	.0381282	-0.26	1.000	-.1392945	.1191127
Gamoo Niggaro vs Balbalaa Soorgo	-.1918663	.0455657	-4.21	0.002	-.3462732	-.0374595
Adii leka Tullu Chalii vs Balbalaa Soorgo	-.0625806	.0437144	-1.43	1.000	-.2107139	.0855527
Charo Gaabanoo vs Balbalaa Soorgo	-.281914	.0447606	-6.30	0.000	-.4335924	-.1302355
Damuu Geembo vs Balbalaa Soorgo	-.051528	.0509213	-1.01	1.000	-.2240831	.1210271
Lelisa Biyya vs Balbalaa Soorgo	-.1198534	.0437144	-2.74	0.346	-.2679867	.0282799
Hagayyaa vs Balbalaa Soorgo	-.0696395	.0527458	-1.32	1.000	-.248377	.1090981
Hunde Guddinaa vs Balbalaa Soorgo	-.1776715	.0392518	-4.53	0.001	-.3106825	-.0446605
Adii leka Tullu Chalii vs Gamoo Niggaro	.1292857	.0449057	2.88	0.243	-.0228844	.2814559
Charo Gaabanoo vs Gamoo Niggaro	-.0900476	.0459247	-1.96	0.968	-.245671	.0655758
Damuu Geembo vs Gamoo Niggaro	.1403383	.0519476	2.70	0.380	-.0356945	.3163711
Lelisa Biyya vs Gamoo Niggaro	.072013	.0449057	1.60	1.000	-.0801572	.2241831
Hagayyaa vs Gamoo Niggaro	.1222269	.0537372	2.27	0.792	-.0598703	.3043241
Hunde Guddinaa vs Gamoo Niggaro	.0141948	.0405743	0.35	1.000	-.1232978	.1516874
Charo Gaabanoo vs Adii leka Tullu Chalii	-.2193333	.0440885	-4.97	0.000	-.3687342	-.0699324
Damuu Geembo vs Adii leka Tullu Chalii	.0110526	.0503315	0.22	1.000	-.1595039	.1816092
Lelisa Biyya vs Adii leka Tullu Chalii	-.0572727	.0430259	-1.33	1.000	-.2030731	.0885276
Hagayyaa vs Adii leka Tullu Chalii	-.0070588	.0521766	-0.14	1.000	-.1838677	.1697501
Hunde Guddinaa vs Adii leka Tullu Chalii	-.1150909	.0384836	-2.99	0.178	-.2454987	.0153169
Damuu Geembo vs Charo Gaabanoo	.230386	.0512428	4.50	0.001	.0567414	.4040305
Lelisa Biyya vs Charo Gaabanoo	.1620606	.0440885	3.68	0.018	.0126597	.3114615
Hagayyaa vs Charo Gaabanoo	.2122745	.0530562	4.00	0.005	.032485	.392064
Hunde Guddinaa vs Charo Gaabanoo	.1042424	.0396679	2.63	0.447	-.0301788	.2386637
Lelisa Biyya vs Damuu Geembo	-.0683253	.0503315	-1.36	1.000	-.2388819	.1022312
Hagayyaa vs Damuu Geembo	-.0181114	.0583475	-0.31	1.000	-.2158314	.1796085
Hunde Guddinaa vs Damuu Geembo	-.1261435	.0465082	-2.71	0.371	-.2837443	.0314572
Hagayyaa vs Lelisa Biyya	.0502139	.0521766	0.96	1.000	-.126595	.2270228
Hunde Guddinaa vs Lelisa Biyya	-.0578182	.0384836	-1.50	1.000	-.188226	.0725896
Hunde Guddinaa vs Hagayyaa	-.1080321	.048499	-2.23	0.830	-.2723788	.0563146

Source: Computed from own field survey (2019)