Consumption-based and Multidimensional Poverty Dynamics in Ethiopia: Evidence from Spatiotemporal Approach[1]

Aemro Tazeze Terefe,[2] Mengistu Ketema Aredo,[3] Abule Mehare Workagegnehu,[4] and Wondimagegn Mesfin Tesfaye[5]

Abstract

Consumption-based and multidimensional poverty comparison provides a conceptually meaningful, empirically informative and more precise image for policy decisions. This study is a deep drive of consumption-based and multidimensional poverty dynamics and the decomposition of disparities among rural and small towns in Ethiopia. Data from three rounds of the Ethiopian Living Standard Measurement Survey (LSMS) was used to compute the Foster-Greer-Thorbecke index for consumption-based poverty and the Alkire-Foster index for multidimensional poverty. The study considered a balanced sample of 3220 households every three rounds with the corresponding sample weight for the post-stratification adjustments to ensure all regions are represented. Though consumption-based poverty has been moderately declining over time, multidimensional poverty has exhibited inconsistent changes over time. The transition probability of non-poor into poor and/or change to non-poor and poor was relatively high. Multidimensional indicators exhibit backwards or forward

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[2] PhD fellow in Agricultural Economics at Haramaya University, Ethiopia; corresponding author. Email: aemrot@gmail.com.

[3] Professor of Agricultural and Resource Economics at Haramaya University and Chief Executive Officer (CEO) of the Ethiopian Economics Association (EEA), Ethiopia. Email: mengistuket@gmail.com.

[4] Assistant Professor in Agricultural Economics and Head School of Agricultural Economics and Agribusiness at Haramaya University, Ethiopia. Email: abulemehare@gmail.com.

[5] Economist Consultant, World Bank Group, Ethiopia. Email: wtesfaye@worldbank.org.

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movers of deprivations. Specifically, malnutrition and years of schooling showed a high transition probability for households to keep household status. Southern Nations Nationalities and Peoples (SNNPs), Oromia and Amhara regions have the highest relative contribution for both poverty measurements. Female-headed households had a low relative contribution for consumption-based poverty but a high contribution for multidimensional poverty. Moreover, rural areas also contribute more to consumption-based and multidimensional poverty. There is a significant difference in consumption-based poverty based on drought and shortage of rainfall shocks, but no significant change in rainfall shocks in multidimensional poverty. It implies that short-term shocks are more reflected in consumption poverty while simultaneous shocks are significant in multidimensional poverty. Considering both monetary and multidimensional measures is vital to get a complete picture of welfare decomposition and transition. Therefore, it is necessary to design policy interventions that reduce poverty in rural areas, SNNPs, Oromia and Amhara regions and male households with the highest relative contribution of poverty to improve social-economic welfare in Ethiopia.

Keywords: Foster-Greer-Thorbecke index, Alkire-Foster index, decomposition, and transition.
JEL Codes: I27, O19, Q12

1. Introduction

Achieving sustainable and inclusive economic growth is the key focus area of development goals across the globe. These goals include improving welfare, reducing inequality, and setting indicators of multidimensional well-being (Ravallion, 2017; Kim and Heshmati, 2019). World Bank's sustainable development goal is to end extreme global poverty and reduce the poverty headcount ratio from 10.7% in 2013 to 3% by 2030 (UNDP, 2014). According to the World Bank (2018), between 1990 and 2015, the percentage of the world's population living in extreme poverty fell from 37.1 to 9.6 percent. Nevertheless, the money metric approach in measuring poverty is not human-centred, which defines poverty as a scarcity of economic resources or incomes to meet minimum basic needs for a decent life (Mekonnen and Amas, 2021). Though measuring

well-being has involved considerable efforts by scholars, policymakers, and social planners for an extended time (Mekonnen and Amas, 2021), no uniquely agreeable measurement has been overextended so far.

Over the past three decades, the Ethiopian economy has exhibited substantial gross domestic product growth. Reducing monetary poverty is attributed to reform-based government policies and heavy private and public investments. Despite all these steps, the Ethiopian government reported that around 25 percent of the population lives under the poverty line (GTP-II, 2016). This is considering money metric measurements of poverty only. The use of a monetary measure of poverty assumes that markets and prices exist for all goods and services. Hence, this measurement is subject to incompleteness, bias, narrow conceptualizations of the reality on the ground, and eludes precise measurement to address poverty reduction policies. Due to the limitation mentioned above of income and expenditure as a measure of poverty, the multidimensional approach is becoming the traditional method today (Alkire, 2018; Samuel *et al*., 2018; Santos and Villatoro, 2018; Bourguignon and Chakravarty, 2019).

The contemporary empirical and conceptual literature admits that poverty is a multidimensional phenomenon, and measurements that account for various socio-economic aspects of the subject under investigation are prominent. Substantially multidimensional poverty in Ethiopia has decreased between 2002 and 2009, despite a relatively high baseline condition (Mwanakatwe and Barrow, 2010). Disregarding the baseline and relative population growth, Ethiopia has been cited as one of the world's lowest-income countries. According to a global Multidimensional Poverty Index (MPI) report for 2018, Ethiopia seconds Niger in the number of multidimensionally poor people in Africa (Alkire *et al*., 2017; OPHI, 2018). Despite the promising progress, a record of multidimensional poverty is still a deep-rooted societal problem in Ethiopia.

Previous empirical studies have focused on measuring poverty in Ethiopia using monetary and multidimensional approaches. Monetary-based poverty analysis has been used by Kashi *et al*. (2016), Oumer (2016), and Birhan and Tesfahun (2017). Some researchers also conducted multidimensional poverty analysis (Dean and Jolliffe, 2016, Bersisa and Heshmati, 2016; Tigre, 2018, Misganaw *et al.*, 2019; Degye, 2020; Tigre, 2020; Bantayehu and Singi, 2021; Galgalo *et al.*, 2021; Tsegaye, 2021; Desawi *et al*., 2021). Nevertheless, these

studies have ignored some indicators and dimensions; either use specific groups or locations, restrict their analysis to single outcomes, focus on cross-sectional data disregarding dynamism over time, and lack decomposition in subpopulation groups. Others used a short panel and cross-sectional data and examined consumption-based and multidimensional poverty (Dean and Jolliffe, 2016; Tigre, 2018; Tigre, 2020; Megibaru, 2020; Mekonnen and Almas, 2021). These studies are also limited in their coverage, weighting and the data usage.

Consumption-based and multidimensional poverty comparison provides a conceptually meaningful, empirically informative and more precise image for policy decisions. Therefore, the integrated nature of well-being is essential for evaluating poverty levels and reveal the true picture of social problems, capabilities, functioning and distribution. It is also crucial for poverty targeting to advance the distribution of non-market goods, especially in the country that follows developmental state policy. Furthermore, methodologies for a distributive measurement analysis have advanced considerably in recent years and created new possibilities for measuring decomposition. The results of this study would inform policy interventions targeting poverty reduction by considering both consumption-based and multidimensional wellbeing dynamics in conjunction. Additionally, the results would help policy-makers tailor their programs and plans for resource allocation based on specific location and social groups and create a more comprehensive policy formulation. Estimating inequality across regions helps to design anti-poverty interventions. Therefore, this study has adopted and used the integrated theoretical approach of welfare and multidimensional poverty theories to examine the trends, transition, decomposition, and inequalities.

Generally, the contribution of the body of literature in this study is four-fold. First, it uses the recent three rounds of panel data from 2012 to 2016 for measuring consumption-based and multidimensional poverty. Second, it helps a new empirical perspective to compare the dynamics and suggest informed decisions of poverty measurements. Third, it makes decompositions based on location and different social groups. Lastly, it also considers drought reports as a shock and downscaled rainfall at the household level and decomposed rainfall shocks by taking shortage of annual rainfall as a proxy variable for rainfall shock. To the best of the researchers' knowledge, this is the first study to estimate the comparison of consumption-based and multidimensional poverty at the country

level using panel data and applying the Foster-Greer-Thorbecke (FGT) and Alkire–Foster (AF) methodologies by employing Distributive Analysis for Stata Package (DASP).

2. Methodology

2.1 Data Description

The research has used the Living Standard Measurement Survey (LSMS) data, which is conducted by the World Bank in collaboration with the Central Statistical Agency (CSA) of Ethiopia. This comprehensive dataset consists of samples from all regions in the country (nine regional states and two city administrations) representing the national population of Ethiopia. A total of 290 Enumeration Areas (EAs) and 43 EAs from small-towns[6], 12 households in each EAs were selected in the first wave. During the second and third waves, 100 urban EAs were added. The addition also included one more region to the sample, Addis Ababa. In each EA, 15 households were selected. The addition of urban EAs increased the sample size from 333 to 433 EAs. The first wave had a low non-response rate of 0.7 percent; the final interviewed sample was 32025 individuals and 3.969 households; the second wave attrition rate was 4.9 percent producing a sample size of 33147 individuals and 3,776 households. The third wave was about 43785 individuals and 5466 households. However, maintaining the balanced panel sample for this analysis and restricted the final analysis by excluding households missing information related to multidimensional indicators. Restricting households with such item non-response resulted in 2012 and 2014 a loss of 18.87 percent of the sample and in 2016 a loss of 41perecent of sample for both attrition rate and due to excluding unbalanced data. Finally, the study has considered a balanced sample of 3220 households in each round with the corresponding sample weight for the post-stratification adjustments to ensure that all regions are represented.

[6] Operation definition on this research it means all town included in the first wave of LSMS data which was included Addis Ababa city administration.

2.2 Empirical Strategy

Household consumption-based poverty was estimated using the formula given in Haughton and Khandker (2009).

$$P_{ot} = \frac{1}{N}\sum_{i=0}^{N} I(Y_{it} < Z) \quad \textbf{(1)}$$

Where, P_{ot} is the headcount poverty over time, N is the total sample households, Y_{it} is adult consumption expenditures of a household in different period i, Z is consumption-based poverty, and $I(.)$ is the indicator function which is 1 if the expression $Y_{it} < Z$ is true, 0 otherwise. Additionally, the researchers have used a more general class of poverty measures proposed by Foster-Greer-Thorbecke (FGT) (2010) to examine the incidence and depth of poverty since it is decomposable across locations sub-groups climate-induced shocks. As one of the measures proposed by Foster and Thorbecke (2010), it is defined as

$$P_{at} = \frac{1}{N}\sum_{i=1}^{N}\left(\frac{G_{it}}{z}\right)^{at}, \ at \geq 0 \quad \textbf{(2)}$$

Where αt is a measure of the index's sensitivity to poverty and the poverty line at period t. When parameter αt = 0, P_{0t} is simply the headcount index at time t and when αt = 1, the index is the poverty gap index P_{1t} at period t. For all αt > 0, the measure is strictly decreasing in the living standard of the poor. *G* is the number of population subgroups, and Z is the poverty line.

The FGT poverty index (P_t) decomposed population subgroups following Duclos and Tiberti (2016) by regions, sex, residences and shocks in a different time:

$$\hat{P}_t(Z_t, \alpha_t) = \sum_{g_t=1}^{G_t} \hat{\phi}(g_t)\hat{P}_t(Z_{tz}; \alpha_t \ g_t) \quad \textbf{(3)}$$

Where *G* is the number of population subgroups, $\hat{P}(z,\alpha,g)$ is the estimated FGT index of subgroup *g*, $\hat{\phi}(g)$ is the estimated population share of subgroup *g*, $\sum_{g=1}^{G}\hat{\phi}(g)\hat{P}(z;\ a\ \ g)$ is the estimated relative contribution of subgroup g to total poverty.

For multidimensional poverty measurement, three core dimensions and ten indicators developed by Alkire (2011) and Alkire and Santos (2014) have been used with corresponding weights (see in detail Table 1). There are different axiomatic approaches to measuring multidimensional poverty. The dashboard approach is a starting point to estimate the level of deprivation in the dimensions separately (Alkire *et al*., 2011; Ravallion, 2011). This approach helps see the impact of specific policies but does not precisely reflect the joint distribution of deprivations across the population (Alkire *et al*., 2015). The second is the intersection approach if a person can be considered poor if each dimension's achievement is less than the poverty threshold set for that dimension but produces weakly low poverty estimates. The last is the union approach considers an individual to be poor only if the achievement in one of the dimensions falls below its respective threshold. The union approach is very commonly used but leads to exaggerated estimates of poverty. In between these two extremes, MPI is widely used recently (Duclos and Younger, 2006). MPI uses different dimensions and indicators. A poverty cut-off is set for each indicator. Finally, the multidimensional poverty cut-off is developed by combining all the indicators based on the weight assigned to each indicator (Alkire and Foster, 2011).

Table 1: Multidimensional poverty dimensions and indicators

Dimensions of poverty	Indicator	Deprived if…	Weight		Poverty line
Education	Years of schooling	No households' member has completed five years of schooling	1/6	1/18	1/3
	Child school attendance	Any school-aged child is not attending school up to class 8	1/6	1/18	
Health	Child mortality	Any child has died in the family	1/6	1/18	1/3
	Nutrition	Any child for whom there is nutritional information is malnourished	1/6	1/18	
Living standard	Electricity	The household has no electricity	1/18	1/54	1/3
	Improved sanitation	The household's sanitation facility is not improved, or it is improved but shared with other households	1/18	1/54	
	Improved drinking water	The household does not have access to improved drinking water, or safe drinking water is more than a 30-minute walk from, round-trip	1/18	1/54	
	Quality of floor	The household has a dirt, sand, or dung floor	1/18	1/54	
	Cooking fuel	The household cooks with dung, wood, or charcoal	1/18	1/54	
	Assets' ownership	The household does not own more than radio-TV, telephone, bike, motorbike, or refrigerator and does not own a car or truck	1/18	1/54	
MPI(1.00)		MPI poor if deprivation at or above	1/3		1/3

Source: Alkire and Foster (2011); Alkire (2014), and Alkire and Santos (2014).

By following Nawaz and Iqbal (2016) and Nawaz and Iqbal (2021), the household assigned a deprivation score (S_i) based on the weighted deprivations experienced in each indicator. The deprivation score of each household lies between 0 and 1. The deprivation score of each household (S_i) calculated by:

$$S_{it} = (W_1 I_{1t} + W_2 I_{2t} + W_3 I_{3t} + \cdots + W_c I_{ct}) \quad \textbf{(4)}$$

Where, $I_{it} = 1$ if the household is deprived in indicator i; and 0 otherwise, at time t period, and W_i is the weight attached to indicator I with $\sum_{it=1}^{c} W_i = 1$. A column vector $S_{it} = (S_{1t}, \ldots, S_{ct})$ of the deprivation, the score reflects the breadth of each household's deprivation at different period t. A household is deemed to be poor if its deprivation score is equal to or greater than the poverty cut-off, $S_{it} \geq K$. A household is identified as poor if it has a deprivation score greater than or equal to 1/3 (33%) (OPHI, 2014; Dotter *et al*., 2017).

According to OPHI (2010), adjusted headcount (M0) for multidimensional poverty has decomposability and monotonicity properties, applicable for categorical, ordinal or cardinal indicators. Therefore, the LSMS data were fitted to rigorous examination using the distributive analysis strata package (DASP) developed by Duclos and Araar (2013). The headcount ratio (H0), the intensity of poverty (A), and adjusted headcount ratio (M0) (Alkire and Santos, 2010) were estimated. The multidimensional poverty headcount ratio (H), therefore,

$$H0 = {}^{n}/_{N} \quad \textbf{(5)}$$

Where n stands for the number of multidimensional poor households and N is the total number of sample households. The headcount ratio measures the incidence of multidimensional poverty of the households. The average intensity of multidimensional poverty (A) reflects the proportion of the weighted component indicators (WDS), in which, on average, poor people are deprived of (dn). This measure is called the breadth of multidimensional poverty. Technically,

$$A = \sum_{1}^{n} \frac{WDS}{dn} \quad \textbf{(6)}$$

$$MPI = M0 = H0 \times A = \sum_1^n \frac{WDS}{dN} \quad \textbf{(7)}$$

Headcount ratio (H0) is simple to compute and easy to understand. It violates dimensional monotonicity in that the overall multidimensional poverty remains the same if the deprivation of a person increases (Saboor *et al*., 2015). The headcount ratio (H0) is adjusted by multiplying it with the intensity or depth of deprivations (A) being experienced to address the violation of dimensional monotonicity. The inclusion of A in the formula for M_o ensures that both the incidence of MDP and the intensity of deprivations are determined simultaneously (Feeny and McDonald, 2016). The decomposability of multidimensional poverty into sub-populations and dimensions is expressed as;

$$M_0(MDP) = \frac{N_1 M_0(MDP_1)}{N} + \frac{N_2 M_0(MDP_2)}{N} + \cdots \frac{N_k M_0(MDP_k)}{N} \quad \textbf{(8)}$$

Where $N1$, N2 and Nk are different sub-groups of population N, and MDP_1, MDP_2 and MDP_k are different sub-group matrices of the indicator matrix. Therefore, the share/contribution of each sub-group for the overall poverty was:

$$S(MDP_1) = \frac{N_1 M_0(MDP_1)}{N M_0(MDP_1)} \; S(MDP_2) = \frac{N_2 M_0(MDP_2)}{N M_0(MDP_2)} \; S(MDP_k) = \frac{N_k M_0(MDP_k)}{N M_0(MDP_k)} \quad \textbf{(9)}$$

Where (MDP_1) is the share of sub-group MDP_1, (MDP_2) is the share of sub-group MDP_2 and (MDP_k) is the share of sub-group MDP_k of the overall poverty. The contribution of each group for the general poverty level at a time will be:

$$SD_j = \frac{\sum_{i=1}^n (W_i g_{ij})}{\frac{nd}{M_0}} \quad \textbf{(10)}$$

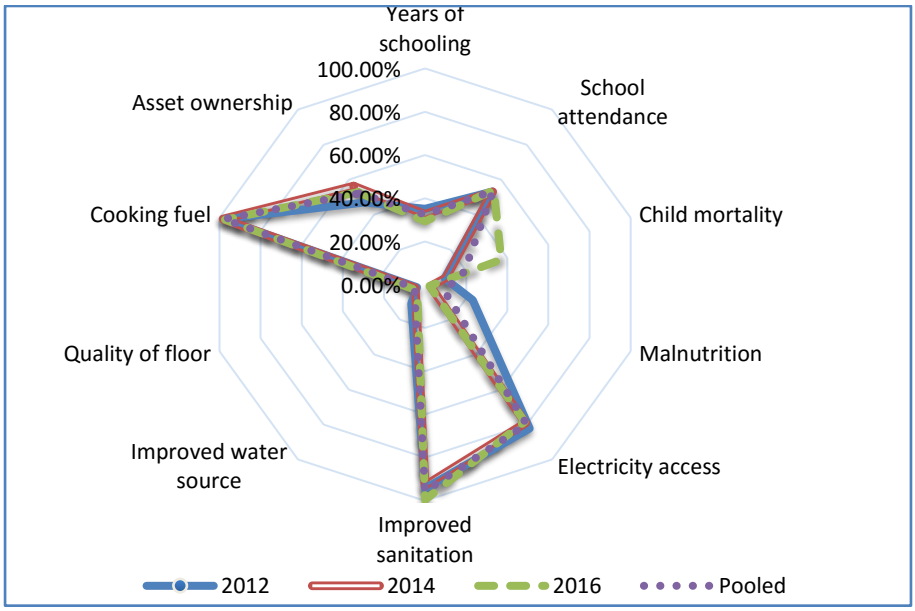
Where, SD_j is the contribution of each dimension for the overall adjusted headcount ratio ($M0$).

3. Results and Discussion

3.1 Comparison of Multidimensional and Consumption-based Poverty

The number of deprived households with the respective percentage of deprivation for each multidimensional poverty indicator is presented in Figure 1 below. These are the percentages of poor individuals in one indicator, regardless of whether the household is deemed multidimensional poor or not.

Figure 1: Multidimensional poverty indictors' deprivation over time



Source: Computation based on ESS[7] (2012, 2014, 2016).

Table 2 shows the level of consumption poverty in Ethiopia using FGT measures of incidence (P0), poverty gap (P1), and severity of poverty (P2) for 2012-2016. Since 2012 Ethiopia has had 38 percent of poverty incidence (P0), 13.1 percent poverty gap (P1), and 6.3 percent severity of poverty rates (P1). In 2016, households experienced a remarkable improvement in consumption-based poverty. The country has witnessed a 25.8 percent of poverty incidence (P0), 8 percent poverty gap (P1) and 3.4 percent severity of poverty (P2). This shows a

[7] Ethiopian Socioeconomic Survey

12.2 percent reduction in the share of the population living in poverty within the year 2012. The decline in P0, P1, and P2 have continued between 2012 and 2016. For instance, the population below the poverty line's share decreased from 38 percent in 2012 to 25.8 percent in 2016 (Table 2). Generally, consumption-based poverty indicators (P0, P1 and P2) have exhibited a declined trend over time in all rounds. According to World Bank (2020a), this progress has been underpinned by robust and sustained economic growth averaging 10.9 percent annually, despite being adversely affected by climate variability and other factors.

Most indicators registered decreases across the three waves except improved sanitation, flooring made, cooking fuel, and asset ownership. Child nutrition and year of schooling exhibited 21.03 percent and 12.02 percent decline, respectively, between 2012 and 2016. The nutrition indicator also registered a declining trend of 31 percent. UNDP (2015) also confirmed that child mortality is declined by 59 percent between 1990 and 2015 in Ethiopia. Though the electricity source shows minimal improvement across time, it is almost effectively stagnant and non-existent. This is in line with the CSA (2016) report where about 80 percent of the sample population is deprived of access to electricity, and more than 95 percent of the population are deprived of cooking fuel and improved sanitation in 2012-2016 (CSA, 2016). Similarly, World Bank (2018) and Migbaru and Zerayehu (2020) reported that the supply of electricity, clean energy for cooking, and improved sanitation are not adequate and contribute to living standards.

Table 2: Consumption-based and multidimensional poverty indices over time in Ethiopia

Consumption-based poverty			Multidimensional poverty			
Year	**P0**	**P1**	**P2**	**H0**	**A**	**M0**
2012	0.38	0.131	0.063	0.750	0.454	0.341
2014	0.314	0.092	0.039	0.681	0.426	0.290
2016	0.258	0.08	0.034	0.776	0.452	0.350
Pooled	0.312	0.099	0.044	0.736	0.445	0.327

Note: P0=incidence of poverty; P1=poverty gap; p2 = severity of poverty;
H0=headcount ratio; A= intensity of deprivation; M0=adjusted headcount ratio.
* Observations weighted to make results representative of all individuals in Ethiopia.
Source: Computation based on ESS (2012, 2014, and 2016)

As depicted in Table 2, relative poverty incidence was higher in 2012, but the gap slightly decreased in terms of incidence, depth, and severity of consumption-based poverty during 2012-2016. It is interesting to footnote that the level of average incidence dropped, showing that poor households were progressively concentrated above the poverty line over time so that the burden of falling poverty chop somewhat. MoFED (2016) also confirmed that poverty in rural Ethiopia had declined consistently in rural areas related to improved agricultural technologies and rural infrastructure. Furthermore, according to Mohammed (2020) and Osabohien *et al*. (2020), the Ethiopian national poverty incidence was 23.5 percent, on the total population in 2015 and 30.8 percent for the international poverty line.

As shown in Table 2, in Ethiopia, multidimensional poverty indices (H0, A, and M0) were declined from 2012 to 2014, but in 2016, it was more significant than before. In 2012-2014 the multidimensional poverty decreased by around 6 percent. Educational dimension (years of schooling life), health dimension (child nutrition), and living standard (access to electricity, improved sanitation, and improved source of water) significantly contributed to the decline of national headcount ratio (H0) and adjusted headcount ratio (M0). This decline mainly can be due to the efforts that the government undertook to improve access to education, health, and living standard, particularly in improved schooling life and school attendance, and improving nutrition, improved water and sanitation (see above Figure 1), even if the change is not that much substantial. This finding is similar to the World Bank (2018) report and UNDP (2015) that the Ethiopian government was implementing development strategies for the last couple of years, enabling the decline of multidimensional poverty.

Within three waves, the headcount ratio (H0) increased by 2.6 percent, and the adjusted headcount ratio (M0) increased by 1.6 from 2012 to 2016. The trend between those statistically significant indicators and dimensions that shows improvement of deprivation over time was less than that declined deprivation. This leads to increases in the deprivation of aggregate multidimensional poverty quietly. However, the level of multidimensional poverty in this result is higher than that reported by UNDP (2018) and OPHI (2018). This is probably due to the sampling weight and the rigorous estimation techniques of Distribute Analysis for Stata Package (DASP). Furthermore, this analysis only focused on rural and

small-town areas, making this significant difference compared with previous studies. In 2014-2016, increasing H0 and M0 could be due to drought shocks in 2015 in Ethiopia, seriously affecting different indicators (child mortality, improved water and housing quality) of multidimensional poverty throughout the nation. World Bank (202b) also supports these arguments that adverse climate affects the livelihood in general and specifically child mortality due to lack of food and coping mechanisms forcing people to sell their fixed assets.

Different dimensions of poverty have contributed differently to multidimensional poverty. Living standard has contributed the most in all-round (around 58 percent, 52.7 percent and 66.9 percent in rounds respectively) followed by education (42 percent, 47 percent and 39 percent in rounds respectively) and health (around 15 percent, 7 percent and 27 percent in all rounds respectively (Table 2). Seff and Jolliffe (2016), Tigre (2018) and Migbaru and Zerayehu (2021) found living standard contributes the most to poverty indices then follows education, but health dimension has the most negligible contribution. The contribution of health (child mortality and nutrition) is the lowest in the panel year compared to other dimensions. This can be due to the improvements in the health service, mainly in child mortality though slightly increase in 2012-2016, and nutrition which decreased by around 23 percent between 2012 and 2016. This finding is similar to that of UNDP (2015) and CSA (2016) in 2012-2014, and Tigre (2018).

When comparing the consumption-based and multidimensional poverty measures at a household level, an appealing question is: "Is it possible to identify the same household as non-poor or poor poverty?" The poverty status match was between 29.13-37.33 percent of sample households between two measures (Table 3).

The percentage of non-poor and poor in consumption-based poverty and non-poor and poor in multidimensional poverty measurements difference is quite significant in all years. Multidimensional poor households are not poor in consumption-based poverty and this paints a different picture of poverty in Ethiopia.

Table 3: Consumption and multidimensional poverty, percentage of households in Ethiopia

		Consumption-based poverty											
	Status	2012			2014			2016			Pooled		
		Non-poor	Poor	Total	Non-poor	Poor	Total	Non-poor	Poor	Total	Non-poor	Poor	Total
MDP	Non poor	22.64	2.39	33.39	29.01	2.89	31.89	20.59	1.83	22.42	24.08	2.37	26.45
	Poor	63.48	11.49	74.97	59.78	8.32	68.11	69.04	8.54	77.58	64.10	9.45	73.55
	Total	86.12	13.88	100	88.79	11.21	100	89.63	10.37	100	88.18	11.82	100
Poverty status match*				34.13			37.33			29.13			33.53

* Status match is the percentage of households with similar poverty status in both measures.

Source: Computation based on ESS (2012, 2014, 2016).

Over time the contribution for some dimensions is not the same. The contribution of education decreased by around 3 percent in 2012-2016. Years of schooling, deprivation had a statistically significant contribution to the decline of their contribution to education in multidimensional poverty (see Appendix Table 1). Nonetheless, living standard dimensions, their contribution decreased in 2014, but it increased in 2016 even if the overtime change in living standards' contribution is not that much bigger. This may be due to an increase of deprivation (indicators except for electricity and improved drinking water) on living standard dimensions (refer above Figure 1).

According to World Bank (2020b), the increment of deprivation for sanitation and diarrhea incidence were directly related to drought shocks. Consequently, the household should sell any asset for coping mechanisms, and mobility leads to an increase in the flooring's deprivation.

Generally, poverty estimates based on consumption-based poverty are lower than multidimensional poverty in all rounds. For example, consumption-based poverty was estimated at 38, 31.4, and 25.8 in 2012, 2014, and 2016 respectively, while the multidimensional poverty estimated for the same period was 74.97, 68.11, 77.58, respectively (see Table 2). Furthermore, estimates suggest that about 8.32-11.49 percent of households were poor in both consumption-based and multidimensional poverty between 2012 and 2016 in Ethiopia. Despite using different approaches to estimating poverty, these results are approaching the national estimates MoFED (2015) suggested. Ilana Seff and Dean Jolliffe (2016) also found significant differences in the poverty estimates between well-being measures based on consumption and multidimensional poverty measurement. The consumption-based poverty trend is more consistently compared to the official poverty result than the multidimensional poverty result.

3.2 Poverty Transition

With this information and through transition matrices, researchers have observed changes in households' different states over time by both measurements of poverty. Consumption-based poverty shows a transition in ascending and descending over time. The transition probability of non-poor into poor and or change into non-poor and poor was relatively high. Regarding multidimensional

indicators of exhibits transitions in and out/backward or forward movers of deprivations. Looking at each of the multidimensional poverty indicators, the transition probability for malnutrition and years of schooling show a high probability for households to keep their status of non-deprivation or change into non-deprivation if they deprived in the initial condition from 2012 to 2016, from 2014 to 2016 and from 2012 to 2014 (Appendix Table 2). The school attendance, source of fuel for cooking, and access to electricity indicators have a relatively low transition probability of a household staying deprived or moving into non-deprivation if initially deprived. In contrast, indicators of access to improved drinking water, quality of housing, and improved sanitation show different trends. Access to drinking water exhibits persistency in deprivation and a higher probability of changing into deprivation if a household is not initially deprived. This suggests that not much welfare improvement was observed for households in terms of improved sanitation, access to electricity, cooking fuel, and housing quality. All are being indicators for a standard living dimension of the multidimensional poverty indicators.

About 77.02 percent of households were always poor or non-poor in all waves (Table 4). Measurement of consumption-based poverty exhibits relatively high transitions in and out/backward or forward movers of poverty compared with chronic poverty. This is consistent with the findings of Bruck and Sindue (2013), Dercon, and Krishnan (2000), who found relatively high transitions in and out of poverty (22.98 percent). Ilana Seff and Dean Jolliffe (2016) also found the changes in consumption and relatively easy for a household to move substantially up or down the consumption gradient over a short period. Furthermore, World Bank (2015b) also reported that around 14 percent of non-poor households are estimated to be vulnerable to falling into poverty in Ethiopia. About 49.99 percent of households were multidimensional poor in either one or two waves (Table 4). More than half of the households are persistently poor in all waves. Researchers found that most households are persistent in multidimensional poverty, both consistently poor and never poor (58.01). Multidimensional poverty analysis was found to depict high persistent nature over time. Because households get most public services and facilities through governments, some of the facilities and services do not have market prices.

Table 4: Movement of households in and out of poverty in the percentage of households

	Consumption-based poverty	Multidimensional poverty
Always poor (three times)	1.96 (63)	50.99 (1642)
Twice poor	6.61 (213)	25.68 (827)
Once poor	16.37 (527)	16.3 (525)
Never poor (always non poor)	75.06 (2417)	7.02 (226)
Persistence status*	77.02(2480)	58.01 (1868)
Transient status**	22.98(740)	41.99 (1352)
Total	100% (3200)	100% (3200)

*Persistent status is the sum of the percentage of households who were never poor and always poor.

**Transient status is the sum of the percentage of households who were poor once or twice.

Source: Computation based on ESS (2012, 2014, and 2016).

For instance, sanitation, electricity, and improved water source lead to multidimensional poverty's persistent nature. This result is plausible as a household is less likely to change some indicators than living standard indicators when facing certain shocks. Ilana Seff and Dean Jolliffe (2016) was reported some multidimensional poverty indicators a part of a structural problem. Additionally, in Ethiopia, a large proportion of the services, infrastructure, and facilities have limited engagement in the formal market and multidimensional poverty indicators not provided by private sectors.

3.3 Decomposition

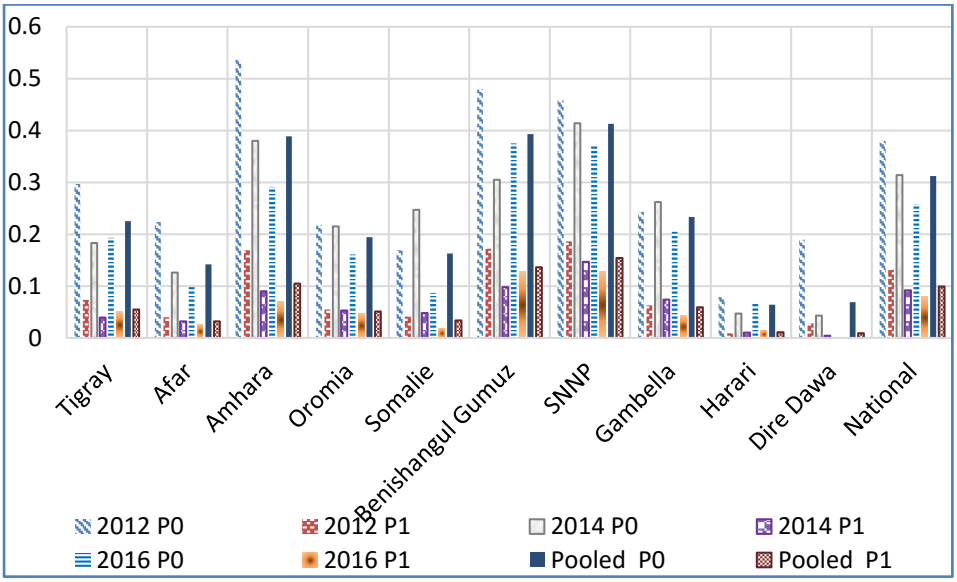
3.3.1 Decomposition by region

The results of the consumption-based poverty incidence and gap of poverty declined over time in different regions. However, poverty incidence is moderately high (Figure 2). Because of the subsistence, a farming system in all Ethiopia regions and the livelihood of the rural population is a mainstay on rained agriculture; poverty is primarily still a rural phenomenon (Alemayehu *et al*.,

2015; GTP-II, 2016). In 2012, poverty incidence is very high in Amhara (0.536), Benishangul Gumuz (0.48), and SNNP (0.458); whereas poverty incidence was lower in Harari, Dire Dawa, and Somalie. In 2014, the highest poverty incidences were in SNNP, Amhara, and Benishangul Gumuz; and in 2016 were Benishangul Gumuz, SNNP, and Amhara.

As shown in Figure 2 though poverty incidence was very high relatively in Amhara regional state, there was a tremendous improvement over time compared with SNNP and Benishangul Gumuz. Poverty incidence, poverty gap, and severity were slightly lower in Somalie, Harari, and Dire Dawa and steadily declined. Especially in 2016, poverty incidence, poverty gap and severity of poverty in Dire Dawa almost was null.

Figure 2: Trend of incidence and gap of poverty in regions and Ethiopia



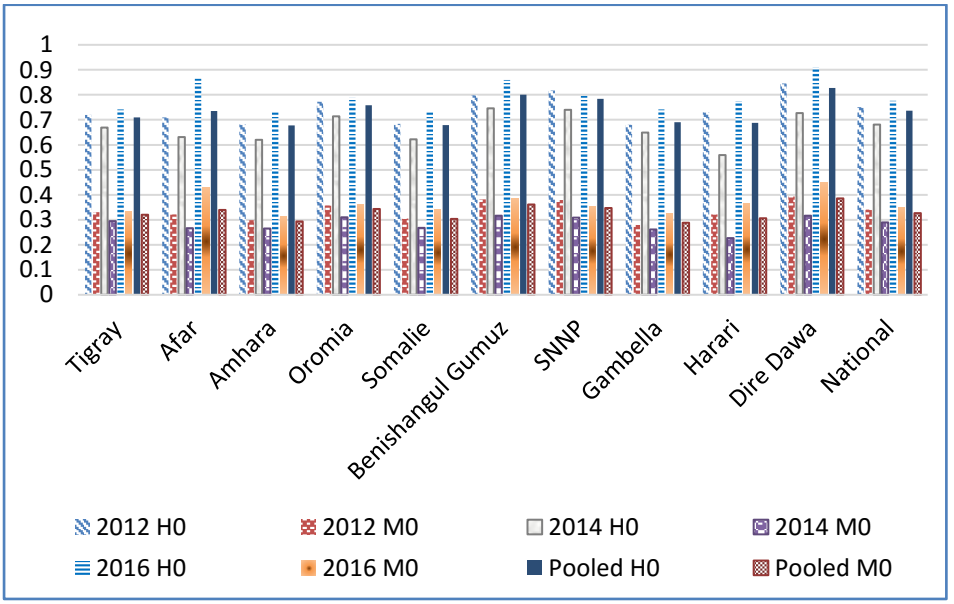
*Observations weighted to make results representative of all regional individuals in Ethiopia. Standard errors are adjusted for stratification and clustering.

Source: Computation based on ESS (2012, 2014, 2016)

Figure 3 shows the estimates of the headcount (Ho) and adjusted headcount ratio (M0) of the nine regional states of Ethiopia and one city administration (Dire Dawa) over three rounds by Alkire and Foster (2007) method.

Some regions showed progress change in H0 from 2012 to 2016, yet the patterns differ across regions. For instance, the headcount and adjusted headcount ratio (poverty profiles) in Dire Dawa, SNNP, and Benishangul Gumuz were very high in 2012, 2014, and 2016 though they showed incrementally in 2014 and a decline in 2016. Amhara, Somalie, and Gambella had a low MPI profile in 2012 compared with the other regions. In these regions, H0 showed further reduction in 2014, but a clear increment occurred in 2016. In 2016, H0 was very high as compared to 2014. Dire Dawa, Benishangul Gumuz and Afar had the least multidimensional poor in 2016.

Figure 3: Trends of multidimensional poverty indices across the region



*Observations weighted to make results representative of all regional individuals in Ethiopia. Standard errors are adjusted for stratification and clustering.

Note: Based on Alkire and Foster (2017), H0=Headcount ratio; M0=Adjusted headcount ratio)

Source: Computation based on ESS (2012, 2014, and 2016)

Though the level of H0 was high in 2016, the rest regions were relatively better compared with Dire Dawa, Benishangul Gumuz, and Afar. The trends for H0 are similar to those for M0: progress in 2012 to 2016 but not always monotonic (for example, SNNP faced higher H0 in 2014 than Benishangul

Gumuz, but SNNP had less in M0 (adjusted headcount ratio) as compared with to Benishangul Gumuz. It implies that the intensity of multidimensional poverty is severe in Benishangul Gumuz.

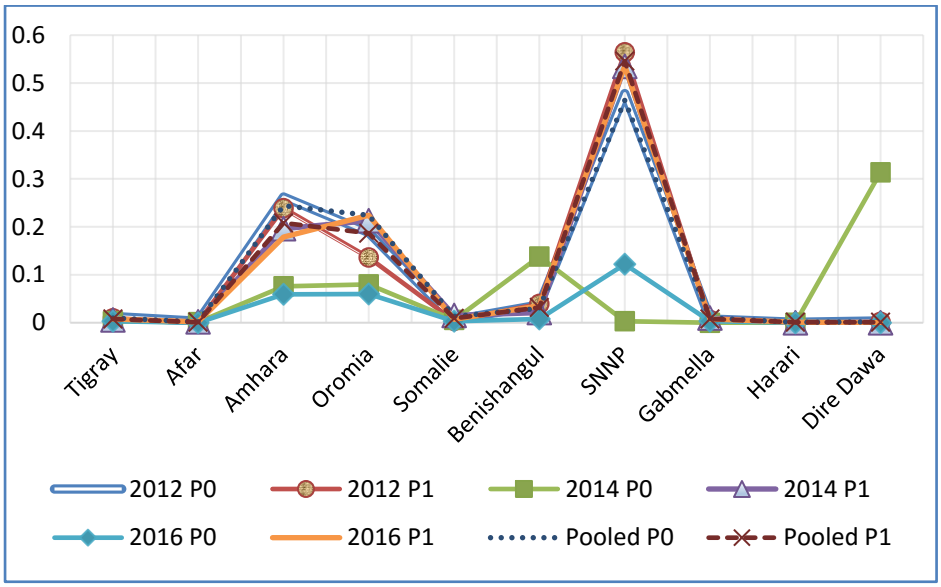
Comparisons of regional multidimensional poverty show that even though there were some differences over the years, the multidimensional poverty (M0) level was high in 2016 in almost all country regions. Particularly adjusted headcount ratio was relatively highest in Dire Dawa, Benishangul Gumuz, and SNNPs regions in 2012, respectively (Figure 3). Generally, the multidimensional poverty indices steadily fluctuate and declined inconsistently over time in Ethiopia. The different trends in multidimensional poverty could be linked to the fact that most multidimensional poverty indicators are service provisions such as health, education, and living standards even though the government has improved provisions via efforts to achieve the 2015 Millennium Development Goals (MDGs). However, this continuing service provision vs population growth rate in the nation is not proportional.

Figure 3 presents a nationally representative picture of absolute and relative consumption-based poverty in different regions. This part goes beyond to assess how widespread relative and absolute poverty has been. In general, the difference in the absolute and relative contribution of poverty among different regions is insignificant over time. Both absolute and relative contribution for prevalence and gap of poverty levels are highest in SNNP, Amhara, Somalie, and Oromia in 2012-2016, where the lowest absolute and relative contribution of prevalence, gap, and severity of poverty recorded in Dire Dawa, Harari, and Afar.

In all regions, the relative contribution of incidence and gap consumption-based poverty has declined over time. There was remarkably little difference in relative poverty in Dire Dawa Harari and Afar, but Oromia is the only region that showed a decline of the absolute and relative incidence of poverty in 2012-2016 predominantly. The relative contribution of SNNP, Oromia, and Amhara for H0 and M0 was very high in all waves. The relative contribution of SNNP declined over time, but in Oromia and Amhara regions, the relative contribution for H0 and M0 increased in 2012-2014. In 2016, the relative contribution for H0 in Amhara was higher than the Oromia region, but the relative contribution for M0 was lower for Amhara compared with Oromia. Gambelia,

Harari, Afar, Benishangul Gumuz, and Dire Dawa had a less contribution for H0 and M0 respectively in 2012-2016.

Figure 4: Relative contribution of consumption-based poverty indices by regions

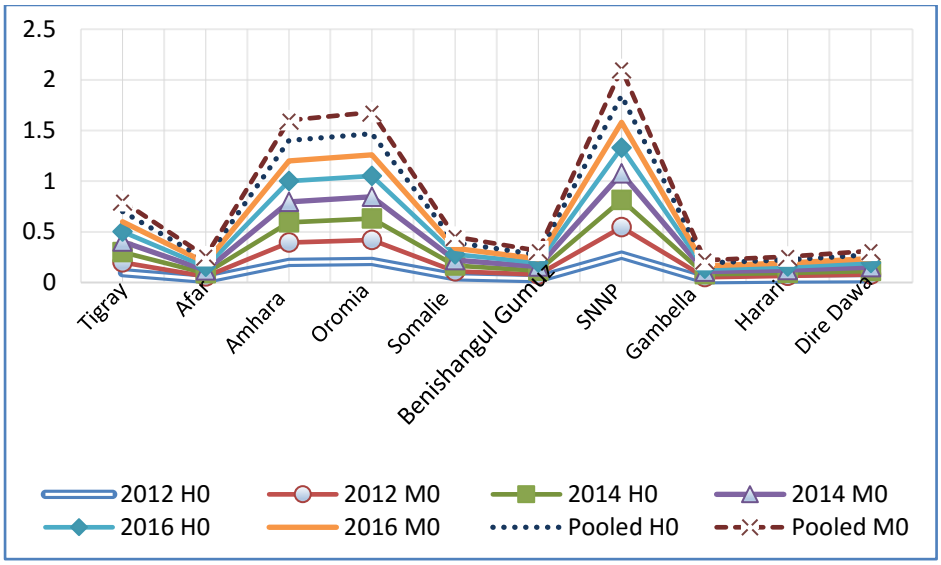


*Observations weighted to make results representative of all regional individuals in Ethiopia. Standard errors are adjusted for stratification and clustering.
Note: P0 is poverty incidence, and P1 is Poverty gap
Source: Computation based on ESS (2012, 2014, and 2016)

Out of the nine regions in Ethiopia and one city administration SNNP, Oromia and Amhara regions constituted about 67.5% of H0 and 67.2 percent of M0 of the country's total population in 2012-2016.

This finding was also similar to the CSA (2010), which stated that the three regions (SNNPs, Oromia and Amhara) had contributed more for relative contribution for multidimensional poverty. Hence, a poverty analysis of these regions can give us a good picture of Ethiopia's multidimensional poverty. Multidimensional poverty relative contribution is very high in regions with large populations while emerging regions contribute less (Figure 5).

Figure 5: The relative contribution of regions to the national multidimensional indices



*Observations weighted to make results representative of all regional individuals in Ethiopia. Standard errors are adjusted for stratification and clustering after constructing the weighted sum of all three dimensions.

Source: Computation based on ESS (2012, 2014, and 2016)

3.3.2 Decomposition by sex

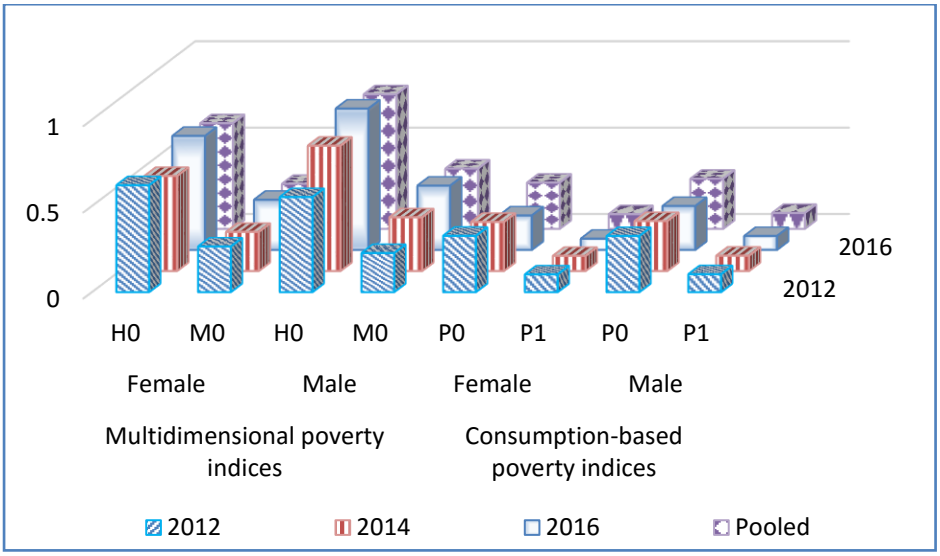
Figure 6 depicted the disaggregation of consumption-based and multidimensional poverty indices by the sex of household heads. Consumption-based poverty by sex of household heads was almost similar across female and male-headed households. Compared to the national level of incidence and depth of poverty, female-headed households incidences were slightly lower than that of male head households. Prevalence and poverty gap for female-headed households were 0.37 and 0.103, respectively, in 2012 and more significant than that of male-headed households (0.326 and 0.104).

Over time, consumption-based poverty for both female- and male-headed households in Ethiopia decreased moderately. Consumption-based poverty in female and male populations was almost similar in 2012, whereas there was a relative improvement in the female population over time. Specifically, the

reduction in poverty incidence and the gap was particularly strong over time for female heads compared with male-headed households. This may be because female-headed households may be more likely to access different social programs, public services, better preference, and test towards consumption instead of saving than male-headed ones.

The trend of multidimensional poverty indices shows that it is high in Ethiopia in general and in female subpopulation households in particular (Figure 6). Probably the female populations, most livelihoods are vulnerable and have less resource ownership or endowments than the male population. In 2012, 2014, and 2016, the share of poor female individuals in the population for H0 was 0.846, 0.928, and 0.934, respectively. There were increments in the percentage of poor female individuals between 2012 and 2014, whereas they slightly declined between 2014 and 2016.

Figure 6: Decomposition and trends of poverty indices by sex of households



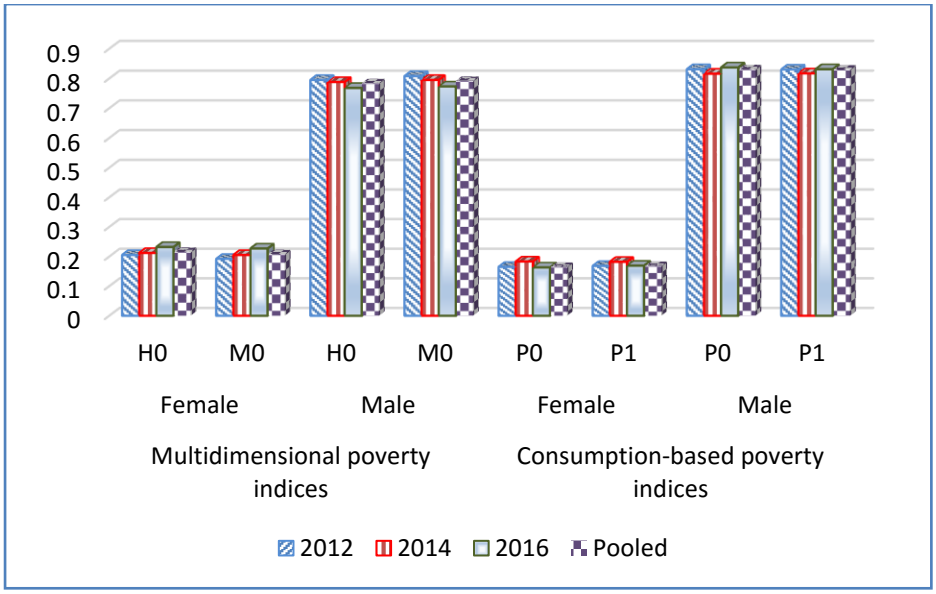
*Observations weighted to make results representative of all regional individuals in Ethiopia.

Note: H0: headcount ratio; M0: Adjusted headcount ratio; P0: Poverty incidence; P1: poverty gap

Source: Own computation based on ESS (2012, 2014, and 2016).

There was a proportional increment in the headcount ratio (H0) of poor female households and the adjusted headcount ratio (M0) between 2012 and 2014 but not in 2016. Multidimensional indices (H0 and M0) have not been decreasing consistently over time; instead, they have been significantly increasing between 2014 and 2016 and slightly declined between 2012 and 2014. Ethiopia was committed to attaining the MDGs by 2015. It developed the first Growth and Transformation Plan (GTP-I) and (GTP-II), designed to maintain rapid and broad-based growth and eventually end poverty. This may be because female-headed households are associated with more climate-sensitive resources and access to land or the credit market and information on risk-coping techniques. This argument is also revealed by Huynh and Resurreccion (2014), and World Bank (2020b) reports. However, this evidence is not generalizable as the social norms gender embedded may determine an advantaged or disadvantaged condition.

Figure 7: Relative contribution of sex household groups for poverty indices



Note: H0: headcount ratio; M0: Adjusted headcount ratio; P0: Poverty incidence; P1: poverty gap

Source: Computation based on ESS (2012, 2014, and 2016)

Although female-headed households relatively had low consumption-based poverty and high multidimensional poverty indices compared with male-headed ones, the relative contribution for both consumption-based and multidimensional poverty indices is significantly low, but the contribution increased over time. In consumption-based poverty, female-headed households' relative contribution increased for incidence and poverty gap in 2012-2014 but eventually declined in 2016. In 2012-2014, male-headed households' relative contribution for poverty incidence declined though the relative contribution is high, and the poverty gap was increased. Female-headed and male-headed households' relative contribution for multidimensional poverty indices declined in 2012-2014 but increased in 2014-2016, as shown in Figure 7. This finding is also similar to that of Tigre (2020), which indicated gender-based decomposition incidence of consumption poverty is high for male-headed households compared to female-headed households in Ethiopia.

3.3.3 Decomposition by residence

Figure 8 depicted the distribution of multidimensional and consumption-based poverty indices over rural and small towns. Consumption-based poverty showed that the relative majority of the population are above the poverty line in rural areas. The prevalence and gap of rural poverty indices were higher (0.297 and 0.094) than that in small-town (0.185 and 0.055) areas in 2012-2016. However, poverty is relatively more prevalent in rural areas of the country. This is comparable to Ethiopia's poverty, where rural areas are relatively worse-off in poverty than their small-town counterparts. According to World Bank (2020b), poverty decreased from 30 percent in 2011 to 24 percent in 2016 in rural areas and from 26 percent in 2011 to 15 percent in 2016 in urban areas despite adverse climatic conditions of poverty reduction in Ethiopia. In rural areas of Ethiopia, the poverty reduction was relatively slow, with the poverty rate decreasing by four percentage points compared with the reduction of poverty rate tumbling by 11 percent in urban areas.

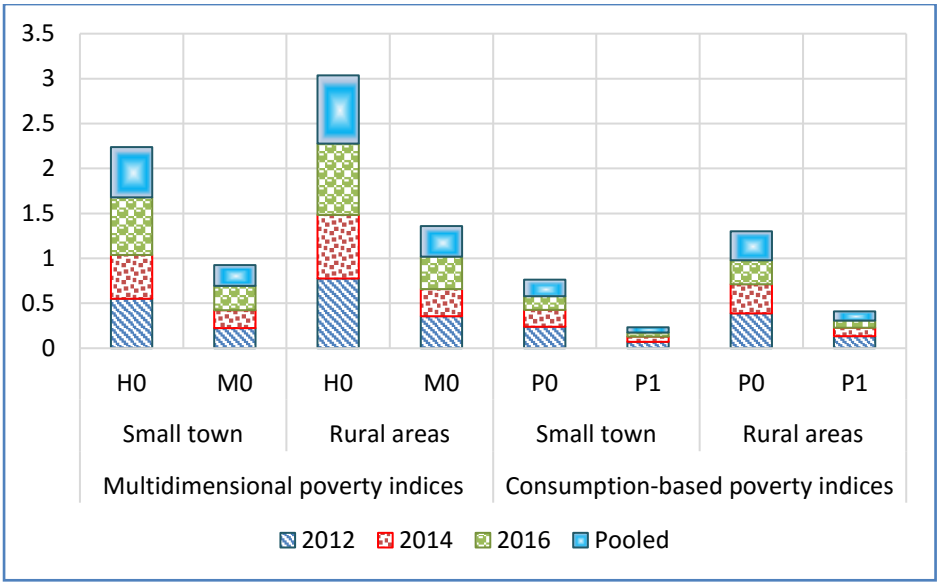
Generally, over time, poverty in rural and small-town areas has decreased moderately, but the poverty reduction was particularly strong in small-town areas. It implies the poverty reduction was particularly strong in small-town areas. This

is probably because participating in non/off-farm activities would be very high, and better awareness of quality life is better in small towns than in rural areas. This is clear evidence that suggests the need to design policy interventions to reduce poverty in rural areas where poverty is worse than in small-town areas. This finding is similar to the work of Tigre (2018), Tigre (2020) and World Bank (2020a).

As Figure 8 depicted, the decomposition of consumption-based poverty and multidimensional poverty indices are high in rural areas than counter-intuitive. A steady pattern has been observed in the relative contribution of consumption-based poverty indices in rural and small-town areas in 2012-2016. The relative contribution of poverty in rural areas was very high compared with the small town over time. Poverty reduction in rural areas was relatively subdued, and this result is similar to the World Bank (202b) report. This is mainly because the government was focusing on towns, and the rural areas did not get equal attention. This finding was in line with Alemayehu *et al*. (2015), GTP-II (2016), and Tigre (2018). As expected in both measurements, poverty indices are high in rural areas. Because of the traditional farming system followed in the rural population, the livelihood is dependent on agriculture. Inherently agricultural farming is most vulnerable to different shocks and risks. Furthermore, different infrastructures and services are relatively minimal in rural areas.

Over time, small-town and rural areas multidimensional poverty indices are not consistently declining, whereas consumption-based poverty incidence and poverty gap in small towns and rural Ethiopia decreased moderately (Figure 8). Increment in multidimensional poverty indices between 2014-2016 maybe because of the improvement in social infrastructure and public service, access to electricity, water and health services, and other services are not proportional to population growth in the country and due to the adverse effect of extreme poverty climate events. This has also been revealed by Tigre (2018) and World Bank (2020a). Education, health, and living standard dimensions of poverty were improved alongside over time but remained at a low level (World Bank, 2020b)

Figure 8: Decomposition and trends of poverty indices by residence

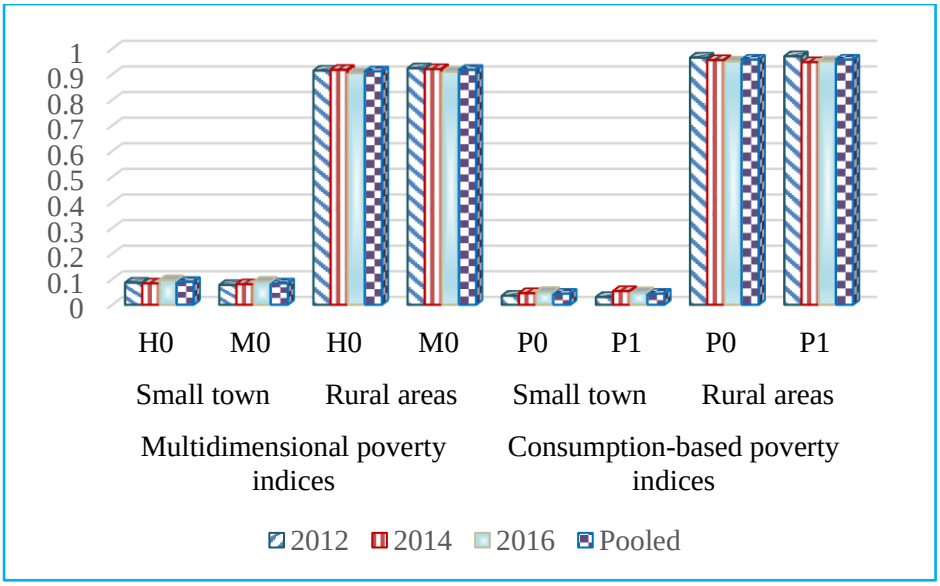


Note: H0: headcount ratio; M0: Adjusted headcount ratio; P0: Poverty incidence; P1: poverty gap

Source: Own computation based on ESS (2012, 2014, and 2016).

As shown in Figure 9, the relative contribution of small-town for total multidimensional poverty indices is low compared to rural areas. Over time, relative contributions of the rural areas have changed inconsistently. For instance, declined in 2014-2016 but slightly increased in 2012-2014. For small towns drops in 2012-2014 but did not fall in 2014-2016. It implies that the Ethiopian government has given attention to rural areas, though the contribution is still by far higher compared with small towns.

Figure 9: Contribution of subgroups to indices (percentage)



Note: H0: headcount ratio; M0: Adjusted headcount ratio; P0: Poverty incidence; P1: poverty gap

Source: Own computation based on ESS (2012, 2014, and 2016).

3.3.4 Decomposition by shocks

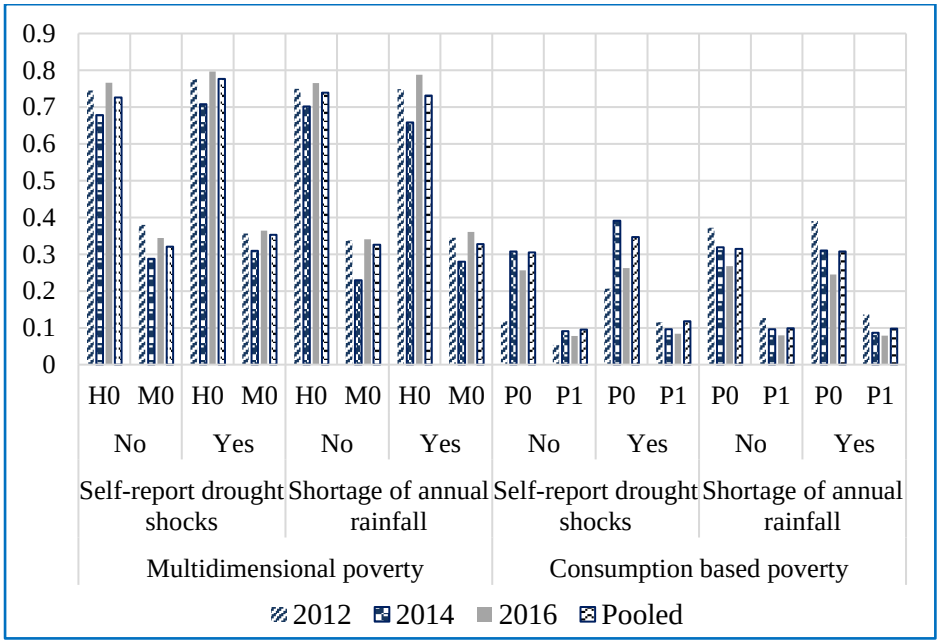
Figure 10 also reports the decomposition of multidimensional and consumption-based poverty indices by different climate-induced shocks over time—the result of comparison between who reported the existence of drought socks or not by using shortage of rainfall[8] and self-report drought[9]. There is a significant negative impact of (self-reported) drought exposure on consumption when using a self-reported indicator of drought exposure. For consumption-based poverty, both incidence and gap of poverty somehow vary over time

[8] The estimated rainfall has been taken as shocks as normalized deviations in a single annual rainfall from the expected yearly historical rainfall over the 17 years (2001–2017). Shortage of rainfall is identified as one standard deviation away from the historical mean rainfall and is then coded as a binary dummy variable (=1 if the household experienced drought at time t and 0 otherwise).

[9] It is dummy variables that measured the perception of households about the drought occurrence. Suppose the answer is yes/one if the households perceived a drought; otherwise, no/zero.

inconsistently between two groups, and the difference is not significant. This is likely due to the endogeneity problem. That is for households who reported the drought shocks, the headcount ratio and adjusted headcount for multidimensional poverty and the incidence and gap of poverty for consumption-based poverty were relatively higher than those who did not report drought shocks over time. Bachewe *et al*. (2017) found that actual cereal prices increased during the drought, consistent with a story of high agricultural impacts of the drought, consequently affecting consumption. In consumption-based poverty, such climate-induced shock could seriously affect the households′ absorptive capacity by selling liquid assets and if the government develops social protection programs. The study has used data on a sample of Ethiopian households observed before (2014) and after/during the drought (2016).

Figure 10: Multidimensional and consumption-based poverty indices by shocks



Note: H0: headcount ratio; M0: Adjusted headcount ratio; P0: Poverty incidence; P1: poverty gap

Source: Computation based on ESS (2012, 2014, and 2016) and CHIPS[10]

[10] Climate Hazards Group InfraRed Precipitation with Station

World Bank (2020b) also reported that climate-related variables positively affect multidimensional poverty in Ethiopia. Researchers have found a clear negative impact of the drought on household welfare. Using drought indicators based on remote sensing data, Sohnesen (2019) did not see an impact of rainfall on consumption.

Regarding multidimensional poverty, drought has adversely affected improved water, electricity access, and improved sanitation due to shortage of water. However, households with a shortage of mean annual rainfall had almost similar H0 and M0 in 2012, better H0 and M0 in 2014, and less H0 and M0 in 2016. It implies that rainfall shortage did not affect multidimensional poverty in the short run. The evidence suggesting that shocks can drive changes in consumption-based poverty in the short run and multidimensional poverty indices, in the long run, implies that deprivation can be a useful indicator for monitoring adverse shocks reactions. People who have had a bad year are more likely to report exposure to shocks. Similarly, Hirvonen *et al.* (2020) found that the drought did not lead to a widespread increase in the health dimension of poverty but an adverse impact in areas with a limited road network.

4. Conclusion and Policy Implications

Consumption-based and multidimensional poverty assessments based on household-level panel data provide a complete picture of wellbeing dynamics. In the overall survey year, the incidence of consumption-based poverty was very small compare with multidimensional poverty. Furthermore, most of the large portions of sample respondents who are multidimensional poor are not poor by consumption. The poverty status match found between 29.13-37.33 percent of sample households between two measures. This result shows that the two poverty measurement methods are relatively not comparable and had no similar status. The minimal overlap between consumption-based and multidimensional poverty implies that the two poverty measures portray and paint a different picture of poverty in Ethiopia. Measurement of consumption-based poverty exhibits relatively high transitions of poverty as compare with chronical poor. Consumption-based poverty shifts more substantially. Most households are

persistently multidimensional poor in all waves, and depict high persistent nature over time.

The results of the consumption-based poverty indices declined over time in different regions. However, poverty incidence is relatively high in Amhara, Benishangul Gumuz and SNNP over time. However, there was a tremendous improvement in poverty incidence in Amhara over time compared with SNNP and Benishangul Gumuz. In all regions, the relative contribution of consumption-based poverty has declined over time, but Oromia is the only region that predominantly declined absolute and relative poverty. The trend of multidimensional poverty steadily fluctuated and declined inconsistently over time in Ethiopia. The different trends in multidimensional poverty indices could be linked to the fact that most of the multidimensional poverty indicators with population growth rates in the nation are not proportional and comparable. Specifically, multidimensional poverty indices are high in Dire Dawa, SNNP, and Benishangul Gumuz over time though these regions showed a progressive decline in 2016. The intensity of multidimensional poverty is very severe in Benishangul Gumuz. The relative contribution of SNNP, Oromia and Amhara almost constituted about 67 percent of the relative contribution of the country's total population.

Female-headed households relatively had low consumption-based poverty and high multidimensional poverty indices compared with male-headed ones, the relative contribution for both consumption-based and multidimensional poverty indices is significantly low, but the contribution has increased over time. Furthermore, poverty in rural areas and small-towns decreased moderately, but the poverty reduction was particularly strong in small-town areas. It implies the poverty reduction was particularly strong in small-town areas. The relative contribution of poverty in rural areas was very high compared with the small town over time. Nevertheless, a steady pattern has been observed in the relative contribution of consumption-based poverty indices in rural and small town's areas but not consistently decline multidimensional poverty indices. The relative contribution of small towns for total multidimensional poverty indices was low compared to rural areas.

The result vividly shows the importance of including long-term welfare indicators when analyzing poverty to complement money metric poverty measures to understand poverty status and its triggers better. Perhaps more interesting from a policy perspective is the different results observed between these two types of poverty measurement dynamics. Therefore, the consumption-based and multidimensional poverty measurement could provide information that can help to initiate in-depth studies at regional levels with different social groups for evidence-based, effective policy and program planning. Policymakers should consider both money metric and multidimensional poverty measurements to see the important changes in the wellbeing of households. Generally, at a national level, setting the ultimate goal of poverty eradication, narrowing the gap between regions, location, social group, the incidence of climate-related shocks, promoting the fairness of distribution of services and facilities, and reducing multidimensional deprivation of poor population are necessary. Therefore, Ethiopia and its different government stakeholders need additional efforts to improve the citizens living standards dimensions, particularly access to electricity, improved sanitation, improved water services and housing, and hence, to bring a significant difference in fighting against multidimensional poverty.

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Appendices

Appendix Table 1: Contribution of each indicator (percentage) for M0

Indicators	2012 M0	2014 M0	2016 M0	Pooled M0
Education	0.421	0.473	0.391	0.426
Years of schooling	0.168	0.18	0.138	0.161
School attendance	0.253	0.293	0.253	0.265
Health	0.157	0.07	0.271	0.14
Child mortality	0.045	0.055	0.171	0.093
Nutrition	0.112	0.015	0.1	0.047
Living standard	0.58	0.527	0.699	0.575
Electricity	0.105	0.11	0.1	0.105
Improved sanitation	0.118	0.125	0.123	0.122
Improved drinking water	0.014	0.01	0.008	0.01
Quality of floor	0.004	0.005	0.007	0.006
Cooking fuel	0.121	0.13	0.121	0.124
Assets ownership	0.061	0.077	0.069	0.068

* Observations weighted to make results representative of all individuals in Ethiopia.
Source: Computation based on ESS (2012, 2014, and 2016)

Appendix Table 2: Transition probabilities of indicators, multidimensional poverty and consumption poverty

Dimensions	Indicators		2012-2016		2014-2016		2012-2014	
			Not deprived	Deprived	Not deprived	Deprived	Not deprived	Deprived
Education	Years of schooling	Not deprived	80.28	19.72	83.99	16.01	84.3	15.7
		Deprived	52.87	47.13	42.98	57.02	36.43	63.57
	School attendance	Not deprived	68.66	31.34	71.46	28.34	75.2	24.8
		Deprived	26.13	73.87	23.45	76.26	22.0	78.0
Health	Child mortality	Not deprived	63.73	36.27	63.7	36.3	91.15	8.85
		Deprived	54.64	45.36	55.69	44.31	77.81	22.19
	Malnutrition	Not deprived	98.42	1.58	97.99	2.01	97.9	2.1
		Deprived	96.11	3.89	94.12	5.88	95.57	4.43
Living standard	Electricity access	Not deprived	7.74	92.26	87.67	12.33	88.07	11.93
		Deprived	86.14	13.86	4.16	95.84	6.46	93.54
	Improved sanitation	Not deprived	1.61	98.39	2.63	97.37	27.96	72.04
		Deprived	0.33	99.67	0.23	99.77	5.8	94.2
	Improved water source	Not deprived	94.81	5.19	94.57	5.43	94.53	5.47
		Deprived	87.36	12.64	86.86	13.14	77.3	22.7
	Housing quality of	Not deprived	96.22	3.78	97.26	2.74	97.38	2.62
		Deprived	36.72	63.28	25.97	74.03	42.97	57.03
	Cooking fuel	Not deprived	14.55	85.45	24.14	75.86	30.91	69.09
		Deprived	2.47	97.53	2.29	97.71	1.3	98.7
	Asset ownership	Not deprived	67.68	32.32	74.56	25.44	64.46	35.54
		Deprived	24.22	75.78	26.03	73.97	20.33	79.67

Source: Computation based on ESS (2012, 2014, and 2016)