-RESEARCH ARTICLE-

ADAPTING THE UNDP MPI TO DEVELOP A NEW MULTIDIMENSIONAL MEASURE OF CIRCUMSTANTIAL POVERTY FOR HARARE PROVINCE, ZIMBABWE

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─**Abstract**─

The objective of this study is to construct a new Multidimensional Poverty Index (MPI). To achieve the objective, the study uses the United Nations Development Programme (UNDP) MPI to produce a new multidimensional poverty measure using dimensions and indicators from the United Nations Sustainable Development Goals (SDGs) for 2030. The province of Harare in Zimbabwe is used a reference point in this study. Alkire-Foster Method (AF) methodology is used to model the logistic regression which employs 36 indicator variables across various dimensions of poverty. The analysis based on the logistic regression reveals the following insights. First, the MPI for Harare province is 37%. Moreover, Harare MPI by location is estimated to be: Harare rural - 50%, high density locations - 42%, medium density - 25% and low density is 15%. The

analysis reinforces the generally accepted belief that the Harare province is witnessing an extremely high level of poverty. The extreme level of poverty in the province of Harare requires immediate interventions for the country to achieve SDG targets of reducing poverty in all its dimensions in a dedicated approach that ensures that no human lives under the poverty line (UN, 2019). The first port of call is to reduce poverty in rural locations in Harare report a head count poverty of 100% where the need for policy and programmatic interventions is most pronounced.

Key words: Multidimensional poverty, poverty indicators, poverty cut-offs, Harare province, UNDP

JEL Classification: I30; I32; I38

1. INTRODUCTION

Poverty is a serious sepulchral global problem which has endured through human history since time immemorial. Poverty is undesirable decadence because it leads to unwanted circumstances such as; increased prostitution, high HIV rates, illness in various forms and ultimately death (Garland, Massoumi, & Ruble, 2007; Rodrigo & Rajapakse, 2009). It is a fact that the impact of poverty is worse in children; and it is reported that 17 million children experience poverty in the form of malnutrition and resultantly, it leads to over 1,000 deaths of children under 5 years every day (UNICEF & Organization, 2017). According to the World Bank (2019), poverty is increasing every minute across the globe and more exponentially so in Africa. It remains an important but underrated fact that poverty measurements should be multidimensional if SDGs are to transform human lives to desired levels (Coromaldi & Zoli, 2012) because multidimensionality gives a wider scope to understanding poverty circumstances.

Measuring poverty must incorporate all forms of deprivation experienced by people ranging from economic, social, and environmental aspects (S. Alkire, Apablaza, & Jung, 2014; Coromaldi & Zoli, 2012; Nussbaum, 2003) although this is lacking in most poverty measurement studies. Townsend, 1979 recommends that poverty measurement should be multidimensional because it is a "structuration aspect". This was later corroborated by Giddens (1984) when the scholar describes how multidimensional poverty measurement is ideal as it indicates the routinisation of "the transcending of time and space in human social relationships". Despite researchers consenting to the notion that poverty is a multidimensional phenomenon, little has been advanced to include dimensions of poverty into a single poverty measure (Bourguignon & Chakravarty, 2019). Multidimensional poverty measurement has not been extensively used to measure poverty and this is unfortunate as it remains the most viable tool to ascertain and quantify the magnitude of poverty experienced by communities (Coudouel, 2002). Except for

multidimensional poverty measurement by UNDP in 2010 & 2018; World Bank study of 2018, most studies have preferred unidimensional poverty measures due to its simplicity however, this leads to incompleteness of poverty measurement (Cellini, McKernan, & Ratcliffe, 2008).

The UNDP MPI has been globally accepted to measure poverty and currently 5.9 billion people are sampled to measure poverty using MPI (UNDP, 2020). The UNDP multidimensional poverty index in 2019 estimated global poverty as affecting 1.3 billion people (23.1%); mostly in Africa (72%) of global poverty (UNDP, 2018). However, UNDP MPI uses only three dimensions and ten indicators, leaving other forms of poverty unexplained (S. Alkire & Jahan, 2018). UNDP conceded that their MPI suffered data constraints in many countries forcing it to drop some indicators such as empowerment. UNDP also accepted that its methodology requires policy makers to refine it by including more country-specific indicators and welcomed continuous improvement by researchers to improve its efficiency and effectiveness in investigating poverty (UNDP, 2018, 2020). Poverty measurement improves as the number of indicators improves and some studies have established that poverty indicators can be up to 40 in a single poverty measure.

Urban poverty is a serious problem affecting humanity; it has been disproportionately increasing in developing countries (Bank, 2019; UNDP, 2018) including Harare, Zimbabwe. Multidimensional poverty in Harare is necessitated by the fact that in Zimbabwe, 44.7% of both rural and urban households of Harare province face multidimensional poverty; 73% urban population lives in poverty and of this, 3.8 % are in extreme poverty (Zimstat, 2016). Harare poverty requires in-depth investigation to understand the circumstances of its poverty if it is "to be eliminated in all its dimensions and forms" by 2030 (United Nations, 2016) in line with SDG goal number 1 of the United Nations.

In this paper, a new MPI is constructed to quantify the situation of poverty in Harare province of Zimbabwe. The new and improved MPI is constructed based on the UNDP's MPI. The new MPI is an extension of UNDP's MPI but instead of using just three dimensions, this paper uses thirty-six indicators to construct the MPI. This paper is an important contribution to literature on poverty measurement. Moreover, the paper utilizes the Alkire-Foster Method (AF) methodology to model the logistic form of regression. The findings based on the analysis reveals the following. The MPI for Harare is 37% but for Harare rural, it is 50%. Moreover, the estimated MPI of the high-density locations is 42%. As far as the medium density locations are concerned, the MPI is -25%. Finally, the MPI of low-density locations is 15%. The analysis suggests there is immediate intervention required to ensure the fulfilment of first goal of UN's SDGs of "no poverty".

In the next section, the paper provides a brief overview of existing literature on the poverty measurement followed by data collection process and methodology in Section 3. The findings and discussion are provided in Section 4. Finally, the paper provides conclusions and policy recommendations in Section 5.

2. LITERATURE REVIEW

Generally, poverty measurement is a pre-requisite undertaking before planning programmatic efforts to reduce poverty. de Haan (1997), posits that poverty measurement enables analysis of sectoral poverty growth trends and the determination of the effects of poverty policies interventions. Osberg and Xu (2008), state that poverty measurement helps to determine the level of poverty i.e., "how much poverty is there" and "if poverty is increasing or decreasing." MPI enables researcher to pinpoint the exact level of poverty by location within a broader economy as this will facilitate policy makers in designing and implementing targeted and more responsive poverty policy interventions over time and space.

Zimbabwe poverty measurement is mainly conducted by Zimbabwe National Statistics Agency (Zimstat, 2016). The data for Zimstat for both its Zimbabwe Poverty Report for 2012 and 2017 raises issues regarding the quality of poverty measurement it can carry out. Data is often collected through Poverty Income Consumption and Expenditure Survey (PICES) and Income Consumption and Expenditure Survey (ICES) only Zimstat (2016). Furthermore, Zimstat studies on poverty is predominantly concentrated on rural areas and communal lands for the study on Zimbabwe poverty and less on urban population (Zimstat, 2016), making their studies inadequate to determine national poverty and unsuitable to explain urban poverty. Most available literature on poverty in Zimbabwe such as World Health Organisation (2010); (Agency), 2012; Zimstat, 2016); International Monetary Fund (IMF) (2017& 2018); World Bank (2019) are strongly static poverty measurements. An over-reliance on static poverty for analysis fails to give a clear picture of poverty and is rather inefficient and ineffective in giving full analysis of poverty dynamics over time.

Several existing theories explore why poverty exists and more specifically, why some members of society are poor, and others are non-poor. Poverty theories are divided into behavioral/ cultural, structural, and political theories as promulgated by various schools of thought. These include Classical, Neoclassical, Keynesian, Marxist, Social Exclusion and Circumstantial schools of thought. Since 2010, the UNDP MPI has continuously added to the value of the Human Development Report (HDR) through the work of Alkire and Santos and up to 2014, it has been based on Oxford Poverty and Human Development Initiative (OPHDI) (Dotter & Klasen, 2017). The advent of SDGs in 2015, together with continuous improvements in the quality and scope survey questions for

data on SDG indicators, has helped progressively refine the UNDP MPI in 2018 (Nations, 2015) and this coincides with the Third Decade on Poverty Reduction agenda (2018–2027), as noted by S. Alkire and Jahan (2018). According to UNDP, the data used in MPI is obtained from DHS, MICS, and national household surveys. There are inherent data constraints which lead to missing data sets in some countries on some indicators; hence, proxies are often applied (UNDP, 2010). The MPI is closely related to the headcount method as it measures the size of population in poverty through indicators (weighted). The MPI is made up of 3 dimensions, 10 indicators, and weights.

There are several positives associated with using the UNDP MPI. Firstly, it promotes an understanding of poverty eradication as a process that requires the adoption of broader social and economic dimensions for a more comprehensive conceptualization of poverty than solely relying on economic growth. The simultaneous use of monetary and human poverty aspects by the UNDP enables policy makers to grasp the nature and extent of social and economic poverty prevailing in the economy as well as provides verification for certainty on the effect of economic and social programmes at a country level. Table 1 indicates the UNDP MPI.

It has been reported that the UNPD method leaves questions as to why only three dimensions are profiled when poverty has many aspects that are not catered for in the UNDP MPI? Other researchers have supported using three dimensions as it "keeps the measure simple to understand and keeps policymakers focused on the main issues contributing to human poverty." Nonetheless, there is also the dilemma that too many dimensions and indicators lead to 'confounding effect' in poverty measurement. UNDP MPI remains an inconclusive measure "which requires additional indicators to provide a more detailed account of other important causes of poverty that perhaps should not be overlooked." An increased number of dimensions and indicators can make the measure conclusive and more meaningful in poverty measurement (Mowafi, 2004).

In this paper, we aim to provide a new and improved version of MPI by extending the UNDPI's existing framework for constructing an MPI. The paper extends the three-dimension UNDP's MPI measurement criteria to thirty-six criteria by employing logistic regression. The proposed index is superior to the UNDPI's one and covers most of the dimensions of benchmark poverty index.

3. DATA AND METHODOLOGY

This study identifies the 'household' as its unit of identification rather than the 'individual' as used by several studies before (Agency), 2012; Bank, 2019; UNDP, 2010, 2018, 2020; Zimstat, 2016). This study was performed accurately and with highest

integrity. In addition, this research adhered to ethical guidelines formulated by the North-West University.

Table 1: 2018 MPI: UNDP Dimensions, Indicators, Deprivation Cut Off and Weights

Dimension	Indicator	Deprived if living in the household where	Weights
Health	Nutrition	An adult <70 years or undernourished child	1/6
	Child Mortality	Infant mortality in the family for the last 5 years	1/6
Education	Years of schooling	10 yrs and above members in the family who finished six years of education	1/6
	School attendance	If any child dropout $< 8^{th}$ class in the household	1/6
Standard of Living	Cooking fuel	Backward sources of cooking energy; cow dung, firewood, charcoal, or coal.	1/18
	Sanitation	Poor household sanitation measured using SDG guidelines or sharing sanitation facilities	1/18
	Drinking Water	Unsafe sources of drinking water using SDG guidelines) or more than 30-minute round trip to fetch drinking water	1/18
	Electricity	Non-electrified or lack access to electricity	1/18
	Housing	Inadequate roof, walls, and floor; natural materials used for housing	1/18
	Assets	The household lacks more than 2 assets from given list of household assets such as; radio, computer, bicycle or car	1/18

Table 1: Source: UNDP, 2018

Ethical Clearance was approved with minimum risk by Northwest University EMS-REC (NWU 00785-20-A4) before any data collection process commenced. After ethical clearance, the researcher obtained approval from the Government of Zimbabwe through the Ministry of Public Service, Labour and Social Welfare under whose purview the current study falls. Participants' permission was sought before they were recruited to participate, and informed consent was obtained from all the participants. Participants were assured that their identities would remain anonymous and that their responses would remain confidential.

Stratified simple random sampling technique was used to collect data from all wards in Harare locations (Harare rural, high density, medium density, and low density). In determining the use of the sampling technique, the study considered the following aspects: the desired 95% level of precision, nature of homogeneity and heterogeneity across the wards in Harare, financial implications of the study, nature and objectives of the investigation, total population of Harare (finite) and the wards population is also known and have been demarcated by (Zimstat, 2016). Due to the COVID-19 pandemic, Open Data Kit (ODK) methodology was the most appropriate for data collection and management to reduce human contact by maintaining World Health Organization (WHO) guidelines on COVID-19 pandemic.

The study concentrated on Harare province households with a defined 1,581 million residents (Zimstat, 2016). Harare has 4 locations which are Harare rural, high density, medium density, and low density. Harare urban is made up of 46 ward and 400,000.00 households, with average household sizes of 3.9 people (Zimstat, 2016). Each location is made of approximately 10 wards. The study used households as its unit of identification for sampling (UNDP, 2018; Zimstat, 2016). (Zimstat, 2016) reported that 93% of the Harare population resides in urban districts (wards 2-46) whilst 7% resides in rural district (ward 1). Ward 1 is Harare South which is a peri-urban settlement facing an inevitable encroachment from Harare urbanization. In general, males make up 48% while females constitute 52% of Harare population across all the wards. The map of Harare was put on GPS and wards were demarcated into Harare rural (ward 1), high density, medium density, and low density.

The sample size was determined using Cochran's minimum sample size formula (Cochran, 1977) which was accepted and adopted by several studies (Fowler, 2002; Bartlett *et al.* 2001; Gill *et al.* 2010; Taherdoost, 2016). The formula for determination of sample size used in this study is shown below:

$$n = \frac{Z^2(P(1-P))}{e^2}$$

Where: **n** is the required sample size; **Z** corresponds to the level of confidence required or accuracy of the results; **P** is the % of occurrence or the level of precision; **E** is the % of maximum error required. The main advantage of using this formula is that it gives study precision and an estimation of the level of risk to the study. The total numbers of households in Harare were found to be 400,261 (Zimstat, 2016).

The study was conducted across all 46 wards of Harare province using data collected through questionnaires at the household level across the wards in Harare using stratified simple random sampling (SRS).

The selection of dimensions for poverty measurement is the work of researchers (Mitra et al., 2013). This study uses seven equi-weighted dimensions and various indicators for each dimension that clearly portray the forms and nature of poverty in Zimbabwe. Choice for dimensions and indicators for this study was based on UN SDGs 2030. The study also used distributive reasonableness as proposed by Rippin (2010) and considered dimensions widely experienced in Harare. Table 2 provides both dimensions and indicators used for Harare province MPI.

Poverty threshold of k/d of 33% and above is defined as multidimensionally poor and this has been used before k/d = 33% (Mitra et al., 2013; Stepanikova & Cook, 2008; UNDP, 2010, 2018; UNPD, 2019). The findings obtained from using Harare province's multidimensional measure are compared with UNDP MPI index to see the statistical significance of the weights on the overall multidimensional poverty.

The dimensions and indicators are weighted equally as advised by (S. Alkire et al., 2015) hence; each dimension receives equal weights of 1/7 and indicators are weighted equally within their corresponding dimensions and the total of all dimensions yield a unitary measure (Bader, Bieri, Wiesmann, & Heinimann, 2016; UNDP, 2018). The choice of weights was the researchers' own opinion as advised by Sen: (Sen 1997: 397).

Each household's MPI_0H or simply (MPI_0HH) was used as the dependent variable. The MPI for the study used A &F methodology of 2011 as employed before by other studies (Fonta et al., 2020; Iqbal, Siddiqui, & Zafar, 2020) The head count was multiplied with poverty intensity to measure each household's multidimensional poverty for Harare province and is given as follows:

$$MPI_0H = A * H = \frac{1}{n} \sum_{i=1}^{n} a_i \, k \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots,,,,\dots\dots\dots \, (1)$$

Where;

H is the number of households who are multidimensionally poor

A is the poverty intensity

Table 2: The Dimensions and Indicators for Harare MPI

Dimensions	Indicators	Household is deprived if…	Weight	Main basis for choosing dimensions and indicators
Education B	B1 Household head level of education	Below secondary education	1/35	SDG 4.1.1
	B2 Highest level of education in the family	Low educational achievements (basic schooling) and early school leavers	1/35	SDG 4.1.1
	B3 School attendance	Household with young children (5-16yrs) not in school or preschool	1/35	SDG 4.1.1
	B4 Distance to school (KM)	School children (5-16years) travels at least 5km to nearest school	1/35	SDG 4c
	B5 School materials/needs affordability	Household could not afford to buy school materials for every child in the past 12 months	1/35	SDG 4c
Health C	C1 Distance to nearest clinic	Travels 5km or more to access health care	1/42	SDG 3.8.2
	C3 Serious illness recorded in HH	HH recorded at least twice in a year	1/42	SDG 3.8
	C4 HH affordability of clinic fees	HH does not afford health care	1/42	SDG 3.8.2
	C5 Quality health care services accessibility in the area	There is no health care service for quality service	1/42	SDG 3.8
	C9 HH fitness and exercises	HH not undertaking exercises	1/42	SDG 3.8
	C10 Health insurance	No health insurance in the HH	1/49	SDG 3.8
Standards of Living D	D1 House ownership	HH using illegal dwelling or squatting	1/49	SDG 1.4.2 & SDG 11.1.1
	D2 House size	More than 2 people per room	1/49	SDG 11.1.1
	D4 Sanitation	No access to flush toilet	1/49	SDG6.2.1
	D7 Primary source of cooking fuel	Not using electricity or gas	1/49	SDG7.1.1 & SDG 7.1.2
	D8 Primary source of drinking water	No access to piped water and treated water	1/49	SDG6.1.1
	D8.1 Distance to the primary source of drinking water	Travels more than 30 minutes to obtain HH water for drinking	1/49	SDG6.1.1 & SDG 11.5.1
	D13 Water fees (rates)	HH cannot afford water use fees (rates)	1/49	SDG7.1.1

Source: Researchers' own presentation

Table 2 (Continue….)

Economic Security: E	E1 Employment status HHH	HH unemployed	1/35	SDG 8.3.1 & SDG8.5.2
	E3 Employment status- other HH member	No one in the HH is employed	1/35	SDG 8.3.1 & SDG8.5.2
	E5 Income	Monthly income is below USD$300 or ZWL$ equivalent (PDL) (1USD: ZWL$82)	1/35	SDG1.2.1
	E8 Assets ownership	Does not own 40% of the assets listed	1/35	SDG1.4.2
	E22 Land ownership	HH does not hold any land (commercial or agriculture)	1/35	SDG1.4.2
Empowerment & Participation F	F1 Community decision making	HH or any member in HH does not participate in any community decision making	1/28	SDG1.3.1& SDG16. b.1
	F2 Donor/ Government Financial assistance	HH not in receipt of any financial assistance	1/28	SDG8.3.1 & SDG17.3.2
	F3 Community economic and political participation	If any member (s) in community face discrimination	1/28	SDG1.3.1& SDG16. b.1
	F4 Financial Inclusion	Having no bank accounts or access to any credit financial mode	1/28	SDG8.10.2
Environment and Public Infrastructure G	G1 HH mode of transport	Foot mode of transport	1/35	SDG11.2.1
	G2 HH Community roads infrastructure	Bad or unusable or usable with difficulty	1/35	SDG11.2
	G3 Other Public Infrastructure accessed by HH in the community	There are no other public services/ goods available in normal functional state	1/35	SDG11.7
	G4 Pollution	Facing any serious and continuous form of any pollution within their neighbourhood	1/35	SDG11.1.1 & SDG11.5.1
	G5 Crime/ violence	HH member experienced crime or violence	1/35	SDG16.1
Food insecurity and adaptation H	H1 HH Food Begging	Sent household members to beg	1/21	SDG2.1.2
	H2 Food rationing	Skipped meals	1/21	SDG2.1.2
	H3 Survival adaptation	Gathered wild vegetables	1/21	SDG2.1.1 &SDG2.1.2

Source: Researchers' own presentation

The study performed Hosmer and Leme goodness-of-fit test for the logistic regression. Hosmer and Lemeshow statistic are given as:

$$\hat{C} = \sum_{k=1}^{g} \frac{(O1k - E1k)^2}{E1k(1 - \xi_k)}; E1k = sk\xi_k \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Where;

$O1k$ is the number of observations with (Y=1) out of sk

$E1k$ is the expected event count in the kth group

ξ_k is the average predicted event probability for the kth group.

The logistic regression regressors of the 36 indicator variables are provided in the section above. The indicators are different from the dependent variable in that the dependent variable is an index obtained after applying weights and cut-offs to calculate each household's multidimensional poverty index whilst the dependent variable is applied in absolute terms across the 400 households. The independent variable takes the value of 1 if household is deprived or 0 if otherwise.

Using the indicators provided, the study proceeded to estimate the logistic model of the study. From the 13 significant indicators of the study's 36 indicators defined; the study's predicted model is shown as:

$$P(MPI_0HH(^1/_x)) = 5.440 + B1\ (5.440) + B2\ (4.642) + B3\ (2.186) +$$
$$B4\ (5.646) + B5\ (-3.520) + B6\ (2.592) + B7\ (5.646) + B8\ (4.371) +$$
$$B9\ (5.244) + B10\ (4.459) + B11\ (4.301) + B12\ (3.676) + B13\ (5.681) + \mu_{it}$$

$$\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(3)$$

MPI_0HH is the multidimensional poverty index for each household derived using H*A. MPI_0HH

$B; (B_1, B_2, B_3, \dots, B_{13})$ are significant indicators of the 36 indicators ($B_1, B_2, B_3, \dots, B_{36}$) provided in section 5.5.3 and explained further in Table 6.23 in section 6.5.9.

Prob (MPI_0HH =1/X) is the likelihood that there are multidimensionally poor

Prob (MPI_0HH =0/X) is the probability the household will not be multidimensionally poor

Error-term μ_{it} follows normal distribution, independent, identically distributed (NIID) ~ $(0, \delta^2)$.

The Multidimensional Poverty Index for Harare (MPI_0H) is calculated by multiplying the head count (H) and poverty intensity (A). The Head count is calculated as follows:

3.1 Head Count Poverty (H) for Harare Province

The calculation of Head count is the first step towards calculating the MPI.

The calculation of MPI is given as:

$$H = \frac{q}{n}$$ …………………………………………………………………………..(4)

In the above equation, q stands for the total number of people who are multidimensionally poor. The multidimensionally poor are calculated by adding sizes of households whose values are above the cut off (33.3%).

n is the total sample size. Total population is the number of household sizes sampled, both poor and non-poor count.

Table 3 provides head count poverty for Harare by location.

The results in Table 3 indicate that the head count poverty for Harare incidence is 0.77%. The proportion of poor people in Harare rural was 100%, implying that everyone in Harare rural is multidimensionally poor when head count (H) is used to establish multidimensional poverty. The head count measure found that the proportion of poor people in high density is 0.88% poverty whilst medium density has 0.54% and 0.35% poverty in low density. It can be concluded that in the province, rural dwellers are the poorest when compared to other provinces. Head count poverty measurement shows that everyone in rural Harare is experiencing multidimensional poverty.

3.2 Poverty Intensity for Harare Province

Poverty intensity (A) measures the breadth of poverty. Poverty intensity can be computed by using the following formula:

Table 3: Head Count Poverty Calculation

	Harare Rural	High density	Medium Density	Low density	Total
Multidimensional poor (**q**)	258	915.23	129.39	98.59	1404.22
Total population (**n**)	258	1043	239	281	1821
Headcount (H)	1.00	0.8774976	0.54138075	0.350854	0.7711258

Source: Researchers' calculations using survey data

$$A = \frac{c_i(k)}{q} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(5)$$

where $c_i(k)$ measures the censored deprivation score of each person i.

q refers to the total number of people multidimensionally poor. It is a summation of all multidimensionally poor households multiplied by the household sizes of each household. The weighted number of deprivations for Harare rural is 0.50 while weighted deprivations for low density are 0.48. Medium density and low density have weighted numbers of deprivation of 0.47 and 0.45, respectively.

The calculation of poverty intensity is provided in Table 4 below:

Table 4: Intensity of Poverty

	Harare Rural	High density	Medium Density	Low density	Total
Censored Deprivation Score ci(k)	1235.72	4199.04	535.86	446.18	6416.8
Total Multidimensionally Poor (q)	249	877	115	98	1339
Intensity of Poverty (A)	0.496273	0.4787958	0.465965	0.455285	0.4792233

Source: Researchers' own calculation using survey data

When poverty intensity is used, 50% of rural dwellers are found to in poverty while 48% are poor in high density areas, 47% in medium density and lastly, 46% in low density are poor. Poverty intensity is marginally similar across all locations. The overall poverty is calculated to be 48%.

3.3 Computation of Multidimensional Poverty Index for Harare province (MPI0H)

Finally, the calculation of MPI can be done as we have the head count poverty (H) and the poverty intensity (A). More specifically, MPI is calculated by multiplying head count poverty (H) and poverty intensity (A) as proposed by (UNPD, 2019) and (UNDP, 2018, 2020).

$$MPI_0H = H * A\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(6)$$

where (H) is head count poverty and (A) is intensity of poverty.

The full computation for this study's MPI for the province of Harare in Zimbabwe is presented in Table 5 below

Table 5: Computation of Multidimensional Poverty Index for Harare (MPI$_0$H)

	Harare Rural	High density	Medium Density	Low density	MPIoH
Headcount (H)	1.00	0.8774976	0.54138075	0.350854	0.7711258
Intensity of Poverty (A)	0.49627309	0.4787959	0.46596522	0.455286	0.4792233
MPI$_0$H	0.49627309	0.42014225	0.2522646	0.1597389	0.36954143

Source: Researchers' own calculations using survey data

The overall MPI$_0$H is 0.37 or (37%). Harare rural recorded an MPI of 0.50 implying that 50% of respondents in Harare rural are multidimensionally poor while Harare high density has 42% poor households. Medium density has 25% poor households while low density has 16% poor households. The overall multidimensional poverty for Harare is 37% across all the locations.

4. FINDINGS AND DISCUSSIONS

4.1 Comparison of Multidimensional Poverty in Harare

The current study uses the computed MPI$_0$H in the preceding section to compare multidimensional poverty across 4 locations in Harare province. Figure 1 below depicts the multidimensional poverty index for Harare (MPI$_0$H). Harare rural recorded an MPI of 0.50, high density recorded MPI of 0.42 while medium density recorded 0.25. Harare low density recorded an MPI of 0.16. The results show that poverty is more rampant in Harare rural (50%) followed by high density (0.48).

Harare medium density and low-density areas recorded MPI$_0$ of 25% and 16%, respectively. There was a small difference (0.08%) between Harare rural and high density MPI$_0$H. Low density and medium density MPI$_0$s are below MPI$_0$H indicating that they contribute less to the overall MPI$_0$H. The study expects poverty to decrease as we move from poor income areas to high income areas, and this is confirmed by the results.

The overall Harare MPI (MPI$_0$H) of 0.37 indicates that there is high poverty which is statistically higher than Zimbabwe MPI of 0.137 produced by UNDP in 2015 (UNDP, 2020). The statistical significance of the differences produced between MPI$_0$H and UNDP MPI is attributed to an increase in dimensions and indicators of poverty. Given that Zimbabwe is largely rural populated, it is anticipated that the MPI for Zimbabwe, if calculated using MPI$_0$H, will be higher as more poverty is confirmed in rural areas based on the findings in Figure 1 above. The study findings are in line with previous studies by (S. Alkire et al., 2015) and (UNDP, 2010).
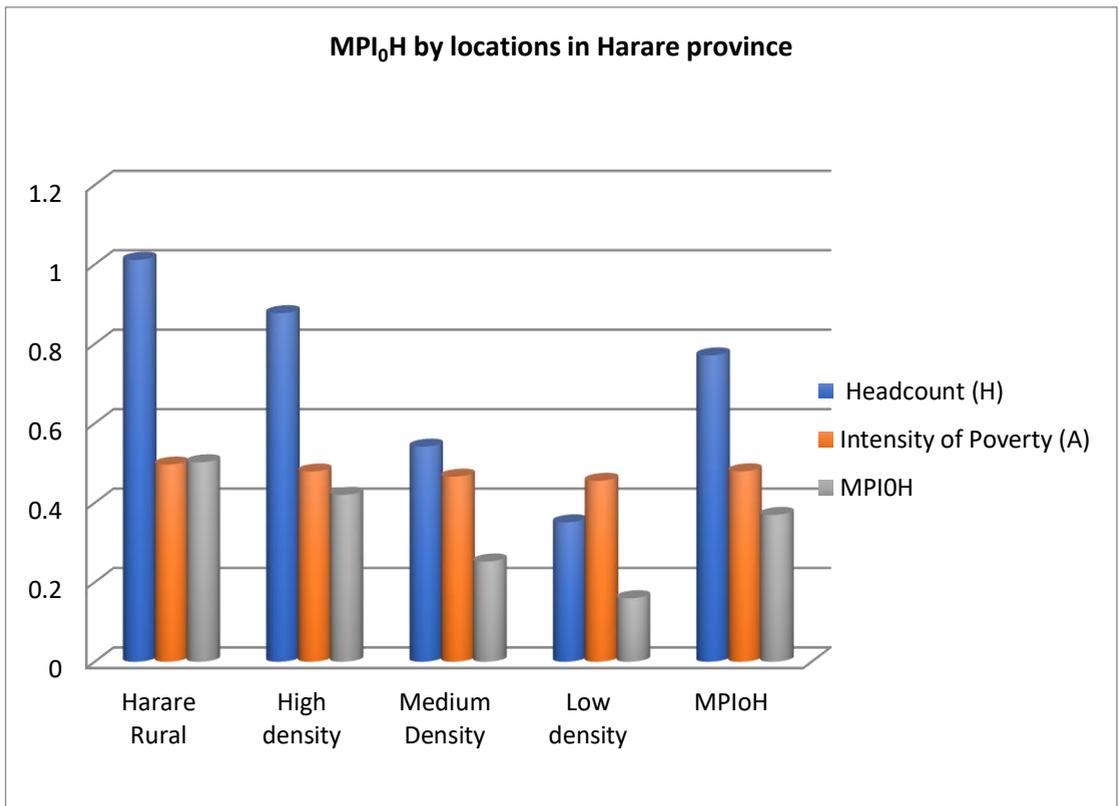
Figure 1: Poverty Head Count, Intensity and MPI in Harare Province Locations
Source: Researcher's own calculations from survey data

4.2 Levels of Deprivation: Varying MPI cut-offs

This analysis was used before by (S. Alkire, Foster, E. J., Seth, S., Santos, M.E., Roche, M.J & Ballon, P, 2014; S. Alkire et al., 2015) and it helps us understand the relationship among Head count poverty (H), poverty intensity (A) and multidimensional poverty MPI. The study uses k=2, k=3, k=4, k=5, k=6 and k=7 to compare results to MPI_0H (k=0.33). Table 6 depicts the relationship between cut offs and deprivation.

The study applies varying cut-offs to understand the behaviour of headcount (H), poverty intensity (A) and MPI. Poverty headcount decreases as cut-off is increased while poverty intensity increases. MPI calculated from varying cut-offs decreases. The graph in Figure 6-7 below plots the relationship between H, A and MPI for Harare province. In rural Harare when k=1, k=2 and k=3, MPI remains unchanged at 51%. In high density areas for cut offs (k=1, k=2, k=3 and k=4), the MPI was between 42% and 44%. MPI for low density is less than the respective MPI for high density for all (k=1 to k=7). An increase in cut offs reduces multidimensional poverty across all locations. In medium density and

low-density areas, when k=7, MPI becomes zero and comes to 0.01 and 0.01 in Harare rural and high-density areas, respectively. Figure 2 provides a clear analysis of the relationship between cut-offs and k-values.
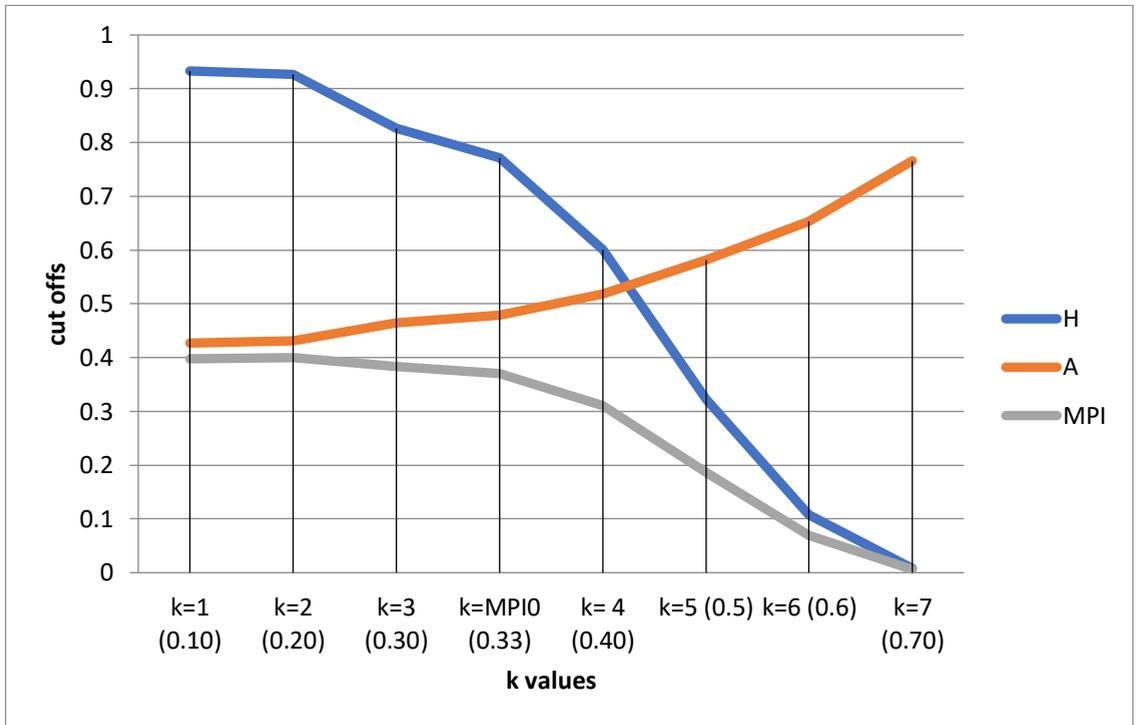

Figure 2: Relationship between Cut-Offs and Cut-Off K Values
Source: Researcher's own calculations using survey data

Poverty intensity increases with cut offs while poverty head count decreases with poverty cut offs. MPI decreases with increase in poverty cut offs and generally the MPI is strongly determined by head count. Cut off k=1, gives highest H and lowest A. At k=1, MPI is at its highest as well. As cut-offs, k increases up to k=7, H and MPI approaches zero which depicts an inverse relationship.

4.3 Harare Province Poverty Vulnerability

Poverty vulnerability is a critical construct to poverty analysis as it offers information on households likely to be pushed into poverty even though they currently qualify as non-poor. Table 7 depicts the poverty vulnerability in Harare province.

The results in Table 7 indicate that 73.8 households are overall vulnerable to poverty for the poverty cut off between above 33% across all locations in Harare province. The most

vulnerable households are in Harare rural which shows a poverty vulnerability level of 96.3%. High density has poverty vulnerability of 83.9% while medium density shows vulnerability of 50.9% and low density stands at 36.1%. The findings confirm *a priori* expectations that rural households are the most vulnerable to poverty and that this vulnerability decreases as we move from households in high density to low density households. Table 8 below depicts the significant indicators of the study.

The standard errors of the model are statistically different from zero implying that they are significant. For this reason, we reject the null hypothesis that variance squared is zero ($H_0 = 0$) while accepting the alternate hypothesis that variance squared is different from zero (H1 =1). The standard errors which are the sum of the square root of the variance (estimated standard deviation) of the sample measure the regression coefficient precision and enable construction of confidence interval around the mean. A total of 13 indicator variables are statistically significant while 23 are statistically insignificant. These have been dropped and are not analysed any further.

Multidimensional poverty in Harare is affected by 13 indicators across 7 dimensions. Years of schooling is statistically significant ($p \leq 0.05$), in reducing probability of multidimensional poverty in Harare and so is the availability of school materials and other school needs by children. The variable 'years not attending school' in continuous Exp(B) can thus be put as [230.423-1] * 100 =22,942.3 (95% C.I 4.023, 13,198.417). This implies that for an additional number of school age not attending school, the odds of multidimensional poverty increase are 22,942.3%.

Wald X^2 on non-school attendance by children of school going age (5-16 years) of 6.938 implies that the indicator is a strong determinant of poverty assuming other indicators remain unchanged. SPSS annotated output indicates that a unit decrease in affordability on school materials/needs leads to an increase in poverty by [103.725- 1] *100 = 10,272.5% (95% C.I 6.496, 1,656.272). The Wald – Chi Squared statistic of 10.782 indicates that holding other indicators constant, unaffordability of school materials would increase the probability of poverty by 10.782. The odds ratios of years of schooling causing poverty falls within range 6.496 to 1,656.272. Education indicators have been determined as a strong force in explaining determinants of multidimensional poverty (Allkire et al. 2014).

Table Error! No text of specified style in document.**: Using Different Cut Offs to Determine Levels of Deprivation Across Harare**

	Rural			High density			Medium Density			Low density			Overall		
K	MP	H	A	MP	H	A	MP	H	A	MP	H	A	MP	H	A
0.10	**.50**	1.00	.49	**.44**	.98	.45	**.32**	.86	.37	**.24**	.73	.34	**.40**	.93	.43
0.20	**.50**	1.03	.49	**.44**	.98	.45	**.32**	.84	.38	**.25**	.71	.35	**.40**	.93	.43
0.30	**.50**	1.02	.49	**.43**	.92	.47	**.28**	.65	.43	**.19**	.46	.42	**.38**	.83	.47
0.33	**.50**	**1.00**	**.49**	**.42**	**.87**	**.48**	**.25**	**.54**	**.47**	**.16**	**.35**	**.46**	**.37**	**.77**	**.47**
0.40	**.45**	0.84	.54	**.36**	.69	.52	**.19**	.37	.52	**.12**	.25	.49	**.31**	.60	.52
0.50	**.33**	0.57	.58	**.21**	.35	.58	**.10**	.17	.58	**.06**	.10	.57	**.19**	.32	.58
0.60	**.14**	0.21	.66	**.07**	.11	.65	**.07**	.11	.64	**.02**	.02	.67	**.07**	.11	.65
0.70	**.02**	0.03	.73	**.01**	.01	.80	**.00**	.00	.00	**.00**	.00	.00	**.01**	.01	.77

Source: Researcher's own calculations using survey data

Table 7: Harare Poverty Vulnerability

	Location: P<0.01 the variation across location is statistically significant									
	Harare Rural		High density		Medium Density		Low density		Total	
Household categories	N	%	N	%	n	%	n	%	n	%
Not Poor	0	0.0%	1	0.4%	2	3.6%	3	4.9%	6	1.5%
Poor (>33% deprivations)	52	96.3%	193	83.9%	28	50.9%	22	36.1%	295	73.8%
Total	54	100.0%	230	100.0%	55	100.0%	61	100.0%	400	100.0%

Source: Researcher's own calculations using survey data

Table 8: Significant Indicator Variables of The Model

Model Significant Indicators	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
B_1: Years not attending school	5.440	2.065	6.938	1	0.008	230.423	4.023	13198.417
B_2: School materials/needs affordability	4.642	1.414	10.782	1	0.001	103.725	6.496	1656.272
B_3: Distance (Km) from nearest health facility	2.186	1.053	4.311	1	0.038	8.896	1.130	70.019
B_4: House size	5.646	1.544	13.370	1	0.000	283.219	13.731	5841.668
B_5: Primary source of cooking fuel	-3.520	1.532	5.276	1	0.022	0.030	0.001	0.597
B_6: Employment status of household head	2.592	1.094	5.620	1	0.018	13.360	1.567	113.920
B_7: another household are employed	5.646	1.394	16.406	1	0.000	283.046	18.426	4347.841
B_8: Asset ownership	4.371	1.349	10.494	1	0.001	79.143	5.621	1114.340
B_9: Land ownership	5.244	1.916	7.494	1	0.006	189.369	4.434	8087.062
B_{10}: nature roads infrastructure	4.459	1.316	11.484	1	0.001	86.365	6.553	1138.244
B_{11}: Pollution	4.301	1.340	10.299	1	0.001	73.780	5.335	1020.375
B_{12}: Skip meals	3.676	1.212	9.206	1	0.002	39.500	3.675	424.572
B_{13}: Borrowed food, or rely on help from friends	5.681	1.368	17.253	1	0.000	293.326	20.096	4281.389
Constant	-31.510	7.342	18.422	1	0.000	0.000		

Source: Researchers' own calculations using survey data set

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

The issue of global poverty is one of the major issues individual countries and regions are facing, especially the Third World countries. Poverty gives way to so many other different issues that has societal implications. For instance, poverty has been found to lead to an increase in crime rates, prostitution, health related problems and sudden death. The continent of Africa has been grappling with poverty issues for many decades and has been the rise as well. There are various organizations that are working to tackle the issue. In fact, United Nations (UN) has presented the idea of Sustainable Development Goals (SDGs). Th main idea behind the SDGs is to motivate countries to move towards more sustainable and inclusive growth. One of the focus of SDGs is to remove poverty. In fact, SDGs are set of 17 goals and "No poverty" is the top goal. Considering the importance of poverty in the global context, the objective of this study is to construct a multidimensional poverty index for Harare. The study is an extension UNDPI's MPI which is based on 3 dimensions. The study uses 36 different indicators and utilize the logistic regression approach to construct the dimensions of poverty.

Findings based on our analysis show 37% multidimensional poverty in Harare province in Zimbabwe. The multidimensional poverty index (MPI) can be further classified into rural areas (with an MPI of 50%), high density areas (with an MPI of 42%), medium density areas (with an MPI of 25%) and finally low density (with an MPI of 15%). The analysis reveals that the situation in Harare is quite dire and alarming in terms of poverty. The MPI of 37% for Harare exacerbates in the case of rural areas, suggesting immediate policy intervention to prevent further worsening of the situation. Dimensions with significant poverty and which require immediate and effective policy interventions are economic security (22.9%) followed by public infrastructure (18.7%), education (13.1%), health (14.2%) and food insecurity (9.2%).

These policy interventions will ensure that Zimbabwe does not deviate from its path to achieving the "no poverty" goal enshrined under the UN SDGs. Local policymakers can work closely with UNDPI and the World Bank to devise an appropriate policy solution to extreme poverty issues prevalent in present day Harare. In fact, dimensions with significant poverty which require immediate policy interventions are economic security (22.9%) followed by public infrastructure (18.7%), education (13.1%), health (14.2%) and food insecurity (9.2%). World Bank (2018:7) noted that "strengthening the linkages between growth and poverty reduction requires a mix of policies…" This paper is an important extension of poverty measurement literature as it provides a new MPI by including thirty-six indicators and is by far the most comprehensive index when it comes to measuring poverty levels in individual countries.

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