Multidimensional poverty and its determinants: Empirical evidence from Nigeria

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Abstract

Eradicating poverty in all its forms is one of the sustainable development goals of the global community. Although meaningful progress has been achieved globally, it remains uneven and unreasonably high in sub-Saharan Africa and Nigeria in particular. There is widespread deprivations in health, education and living standards across states and geopolitical regions in the country. Hence, this study evaluates the determinants of multidimensional poverty in Nigeria using 2016 cross-sectional data. Multidimensional poverty is proxied with Multidimensional Poverty Index (MPI). The data were analysed using analysis of variance (ANOVA), Tukey's test and ordinary least squares (OLS). The ANOVA results show significant variations in multidimensional poverty between geopolitical regions. The Tukey's test reveals significant variations in multidimensional poverty between regions in the south and the north and most sub-regions in the north. There are no significant variations in multidimensional poverty between sub-regions in the south. After controlling for capital expenditure, the OLS results show that labour force and fertility rate have significant effects on multidimensional poverty with the latter exhibiting positive relationship. The paper concludes that with Nigeria's large population, an increase in fertility rate will translate to enormous increase in multidimensionally poor population.

Keywords: ANOVA, Fertility rate, Geopolitical region, Multidimensional poverty index, OLS

1. INTRODUCTION

Poverty is a multidimensional and complex phenomenon (United Nations, 2014; Deinne & Ajayi, 2018; Fonta et al., 2018; Ozughalu & Ogwumike, 2018; Chen, Leu & Wang 2019; Oyekale, Aboaba, Adewuyi & Dada, 2019; Gallardo, 2019; Khan, Saboor, Rizwan & Ahmad, 2020). This attribute has over time created difficulty in reaching a definition that is bereft of biasedness and universally accepted. More specifically, there exist little agreement among researchers and policy makers on the definition of poverty (Laderchi, Saith & Stewart, 2003). Although generally accepted definition is lacking, narrow and broader perspectives of poverty exist in the literature with variations linked to diverse perceptions of well-being (Rohwerder, 2016). From a narrow perspective, Watts (1964) viewed poverty as the relative shortage of goods and services resulting from extreme income constraints. Similarly, Gavillion (1992) defined poverty as the inability to meet minimum needs that are deemed reasonable by the standard of the society. From a broader perspective, Chen et al. (2019) perceived poverty as a set of interrelated forces which are limited resources, need, pattern of deprivation, lack of entitlement and basic security, exclusion, dependency, social class, inequality, economic position and unacceptable hardship. To Alkire et al. (2015), poverty is powerlessness, insecurity, low self-confidence, malnutrition, inadequate health facilities and low social relations. This study follows the Oxford Poverty and Human

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Development Initiative (OPHI) broader perspective and multiple deprivations in health, education and living standards (see Appendix 1).

Poverty amid plenty remains the world's greatest challenge (World Bank, 2001) and poses severe hindrance to economic growth and sustainable development in developing countries, more specifically, in sub-Saharan Africa and Nigeria in particular. In recognition of this fact and the progress made by the United Nations' (UN's) Millennium Development Goals (MDGs) towards reducing world poverty, the UN adopted the 2030 Agenda for Sustainable Development with the desire to complete the task of ending poverty in all its forms everywhere (UN, 2019). Unfortunately, however, while the population of extremely poor people has reduced at the global level, it remains regionally uneven and on the increase in sub-Saharan Africa (World Bank, 2018, 2020) with Nigeria being the worst hit. In 2010, approximately 1.7 billion people worldwide were multidimensionally poor with over one quarter (28 percent) of the people living in sub-Saharan Africa (Alkire & Santos, 2010). Relatively, in 2016, approximately 1.3 billion people globally were multidimensionally poor with an average of 57.5 percent living in sub-Saharan Africa (United Nations Development Programme − UNDP, 2019). The stark rise in poverty headcount in sub-Saharan Africa is the result of a compendium of factors such as slower growth rates, armed conflict, weak institutions and failure to channel output growth into poverty reduction (World Bank, 2018).

Relative to other countries within the sub-Saharan region, Nigeria has the highest number of multidimensionally poor population. According to UNDP (2019), in 2016, approximately 51.4 percent (98,175,000) of the Nigerian population were multidimensionally poor while 16.8 percent and 32.3 percent of the population were vulnerable and in severe multidimensional poverty, respectively. In the year under review, the intensity and index of multidimensional poverty in Nigeria were 56.6 percent and 0.291, respectively. In addition, deprivation in standard of living dimension contributed 40.8 percent to overall poverty in Nigeria while deprivations in health and education dimensions contributed 27.0 percent and 32.2 percent, respectively (see Table 1). When disaggregated, a larger proportion of Nigerian population were deprived of clean cooking fuel (see Figure 1 for proportion of population deprived in different MPI indicators).

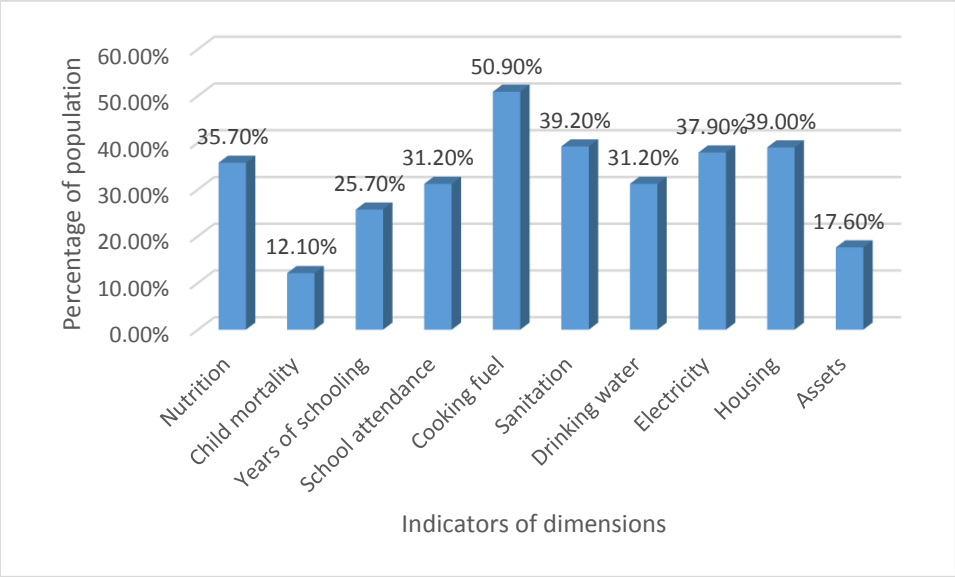
Table 1: Multidimensional poverty of selected countries in sub-Saharan Africa

	Year	MPI value	Headcount (%)	Poverty intensity (%)	Population share (%)		Contribution to multidimensional poverty (%)		
					Vul.	Sev.	Health	Education	Standard of living
Nigeria	16/17	.291	51.4	56.6	16.8	32.3	27.0	32.2	40.8
Congo DR	13/14	.389	74.0	52.5	16.8	43.9	26.1	18.4	55.5
Ethiopia	2016	.489	83.5	58.5	8.9	61.5	19.7	29.4	50.8
Tanzania	11/12	.273	55.4	49.3	24.2	25.9	21.1	22.9	56.0

Source: UNDP, 2019

Note: Vul. and sev. denote vulnerability and severity of multidimensional poverty

Figure 1: Censored headcount ratios − 2016



Source: OPHI, 2018

The disaggregation of MPI by subnational region shows inequality in the distribution of multidimensional poverty across states and place of residence – urban and rural – in Nigeria (see Appendix 2 and 3). In 2016, across the 36 states and the Federal Capital Territory (FCT), Lagos in the south-west has the least index and incidence of multidimensional poverty of 0.01 and 2.4 percent, respectively. Relatively, Sokoto in the north-west has the highest index and incidence of multidimensional poverty of 0.538 and 86.1 percent, respectively. Along the same line, Jigawa in the north-west ranks highest both in intensity and severity of MPI with corresponding values of 64 percent and 62.1 percent, respectively. Ebonyi in the south-east ranks highest with approximately 35.2 percent of its population vulnerable to multidimensional poverty (see Appendix 2 and 3). The north-west has the poorest states with average MPIs of 0.503 and 0.464 in 2013 and 2016, respectively. This is in sharp contrast to the situation in the south-west with average MPIs of 0.087 and 0.061 in 2013 and 2016, respectively (see Table 2 and 3). In addition, 23.9 percent of the urban population were MPI poor while 9.2 percent lived in severe multidimensional poverty. Relatively, 66.1 percent of the rural population were MPI poor and 44.5 percent lived in severe multidimensional poverty (see Table 2 and 3).

Table 2: MPI in Nigeria – 2013

Area	MPI	Headcount (%)	Intensity (%)	Vulnerable (%)	Severe Poverty (%)
National	0.303	53.3	56.8	17.5	32.8
Urban	0.132	28.1	47.0	22.2	10.5
Rural	0.416	70.0	59.5	14.4	47.7
S/West**	0.087	19.3	43.5	25.2	5.3
S/South**	0.107	25.2	42.1	23.7	6.0
S/East**	0.122	27.4	43.7	24.3	8.6
N/West**	0.503	81.0	61.7	10.0	60.6
N/East**	0.472	74.1	58.7	13.9	45.4
N/Central**	0.207	42.5	47.4	21.7	18.6

Source: OPHI, 2017

Note: ** Author's computation using Stata

Table 3: MPI in Nigeria – 2016

Area	MPI	Headcount (%)	Intensity (%)	Vulnerable (%)	Severe Poverty (%)
National	0.294	52.0	56.7	16.9	32.7
Urban	0.114	23.9	47.8	19.6	9.2
Rural	0.385	66.1	58.3	15.5	44.5
S/West**	0.061	13.9	43.2	20.4	2.4
S/South**	0.070	16.9	40.5	21.7	1.5
S/East**	0.065	15.7	40.0	22.8	1.7
N/West**	0.464	76.3	60.4	11.5	49.5
N/East**	0.408	71.6	56.6	14.7	39.1
N/Central**	0.215	42.6	49.3	23.0	15.1

Source: OPHI, 2018
Note: ** Author's computation using Stata

2.0 RESEARCH ISSUE

2.1 Problem statement

Nigeria is regarded as one of the resource-rich countries in Africa (World Bank, 2014; International Monetary Fund − IMF, 2018; Hailu & Shiferaw, 2018). Currently, the country pride itself as the leading producer of petroleum in Africa producing approximately 1, 600, 000 barrels per day (Organisation of the Petroleum Exporting Countries − OPEC, 2020), the second largest bitumen deposit in the world (Federal Ministry of Mines and Steel Development, 2018) and a custodian of other resources that are critical to growth and development. In addition, the country's vast amount of arable land makes it a major producer and exporter of agricultural products like cocoa beans, sesame seeds, cashew nuts, ginger, soya beans, palm kernel oil, to name a few (PricewaterhouseCoopers − PwC, 2019). Given the country's numerous economic potentials, households' deprivations in dimensions such as health, education and living standard ought to be minimal. However, unfortunately, the index, incidence, intensity and severity of multidimensional poverty remain unacceptably high at 0.294, 52 percent, 56.6 percent and 30.7 percent, respectively, in 2016 (OPHI, 2018). In addition, there is conspicuous inequality in the distribution of multidimensional poverty between geopolitical regions in the country, with northern states and rural areas, on the average, being the worst hit (see Table 1 and 2). To address this economic challenge, several anti-poverty programmes and policies have been put in place by successive governments. Some of which are but not limited to: Better Life for Rural Women, National Directorate of Employment (NDE), Directorate of Food, National Poverty Eradication Programme (NAPEP), Family Economic Advancement Programme, Family Support Programme, National Economic Empowerment Development Strategy (NEEDS), State Economic Empowerment Development Strategy (SEEDS), Local Economic Empowerment Development Strategy (LEEDS) and Poverty Eradication Programme (Adeoti, 2014; Oyekale, Aboaba, Adewuyi & Dada, 2019). Sadly, these programmes have not effectively addressed multidimensional poverty as deprivation in health, education and standard of living remain pronounced in the country. It is worrisome to know that 36.8 percent of children in Nigeria are stunted and child mortality rate stands at 132 deaths per 1000 live births; only 39 percent of rural households have access to electricity; 69 percent of Nigerian households use solid fuel; 74 percent of urban and 58 percent of rural households have access to potable water; the net attendance ratio (NAR) is 61 percent at the primary level and 49 percent at the secondary level; and only 56 percent of Nigerian households

have access to an improved sanitation facility (National Population Commission − NPC & ICF, 2019).

Given that poverty is inextricably linked to insurgency, malnutrition and child underdevelopment, traditional fuel consumption and climate change, poor sanitation and adverse health effect, population explosion and high dependency ratio, child labour, out-of-school children, et cetera its pronounce existence will continue to impede growth and development in Nigeria.

Hence, this study seeks to evaluate the determinants of multidimensional poverty in Nigeria using 2016 cross-sectional data. The study delves further to evaluate variations in the distribution of multidimensional poverty between geopolitical regions in the country.

2.2 Justification for the study

Following the review of current and relevant literature, there exist relatively much empirical studies on the determinants of multidimensional poverty across countries and in developing ones in particular. However, in Nigeria, majority of the existing studies focused on the determinants of multidimensional poverty at the micro (household) level with much interest on rural households and their socio-economic and demographic characteristics. Relatively few studies have examined multidimensional poverty from a macro (state) perspective, and even when they exist, empirical evidence is lacking. While majority of the previous studies assessed multidimensional poverty using a binary logit model, only a handful of empirical studies have adopted the ordinary least squares (OLS) technique. Further, most studies on multidimensional poverty rarely give attention to variations in the distribution of multidimensional poverty between geopolitical regions in Nigeria. However, Deinne and Ajayi (2018) relied solely on ANOVA to assess variations in multidimensional poverty between senatorial districts in Delta State without careful consideration of its inherent limitation and possible use of alternative technique for robustness.

Accordingly, this study offers methodological contributions that expand existing related literature. First, the study assesses the determinants of multidimensional poverty from a macro perspective and adopts the OLS estimation technique. Second, it employs both the analysis of variance (ANOVA) and the Tukey's test to assess variations in the distribution of multidimensional poverty between geopolitical regions in Nigeria.

3. LITERATURE REVIEW

3.1 Review of empirical literature

The emergence of MPI has led to a large and growing empirical literature on multidimensional poverty across countries and in developing ones in particular (White & Yamasaki, 2017). Employing the Alkire-Foster method, Karahasan and Bilgel (2019) found that education and health dimensions contributed the most to multidimensional poverty in Turkey while housing and environment dimensions contributed the least. Abeje et al. (2020) adopted Alkire-Foster method and found MPI in Aba Gerima, Guder and Dibatie areas of the Upper Blue Nile basin, Ethiopia, to be 46%, 45% and 45% respectively with living standard and land and livestock ownership dimensions contributing the highest to MPI. Similarly, using Alkire-Foster method, Khan et al. (2020) found increased contribution of household asset dimension and decreased contributions of health and education dimensions to MPI between 2010-2014 periods. In addition, the incidence of multidimensional poverty was found to have increased in the district of Mandi Bahuddin, Pakistan. Adopting Alkire-Foster method and a multilevel modeling technique, Chen et al. (2019) found

different multidimensional poverty profiles for the four districts of Taiwan. Also, micro factors such as age, socioeconomic status, marital status, household income and household size and macro factors such as level of urbanisation and service-to-manufacturing ratio significantly correlate with multidimensional poverty level in Taiwan. Crentsil, Asuman and Fenny (2019) adopted Alkire-Foster method, binary logistic regression and Oaxaca-Blinder decomposition technique in their study. The results revealed that the incidence and intensity of multidimensional energy poverty fell between 2008-2014 periods, and there was significant relationships between household characteristics (socioeconomic and demographic) and the multidimensional energy poverty status of Ghanaian households. Along the same line, Fonta et al. (2018) adopted Alkire-Foster method and found that while water and sanitation (89%) dimension contributed the highest to child MPI in rural areas, child subjective well-being (73%) dimension contributed the highest to MPI in urban areas. Results of the binary logistic regression showed that household size, age, income source, debt status, household head marital status, locality of child, number of siblings, gender of child, education and health condition were significant determinants of child multidimensional poverty in Mouhoun region, Burkina Faso. Using Alkire-Foster technique, Tigre (2018) found multidimensional poverty to be generally high in Ethiopia and in rural areas in Particular. The decomposed MPI showed that Living standards dimension contributed the most to multidimensional poverty whilst education and health dimensions contributed the least. Results of the binary logistic regression revealed that the level of education, having a bank account and the number of independent family members significantly reduced multidimensional poverty in Ethiopia while the number of under-5 children and dependency ratio significantly increased it. Employing the Alkire-Foster technique and a binary logit model, White and Yamasaki (2017) found age, gender, race and ethnicity, education, marital status, employment status, household language and household size to be significant determinants of multidimensional poverty among native- and foreign-born American households. Using Alkire-Foster method and a binary logistic model, Adeoti (2014) found that household size, female headed household, agricultural employment and residing in the northern zones increased the probability of being poor in rural Nigeria whilst educational status, non-agricultural employment and residing in the south west and south east reduced it. More so, health, asset and education dimensions were found to contribute the most to rural multidimensional poverty in Nigeria. Adepoju (2018) adopted the Alkire-Foster method, Markov model of poverty transition and a binary logistic regression in a similar study. The results showed that educational status, household size, number of assets owned and ownership of land influenced transient poverty while marital status, household size, land ownership and number of assets owned influenced chronic poverty among rural households in Nigeria. Also, the study revealed that education and assets dimensions contributed the highest to rural MPI. Employing the Alkire-Foster technique and a binary logit model, Adepoju and Akinluyi (2017) showed that health and education dimensions contributed the highest to poverty and the use of family planning reduced the level of multidimensional poverty among rural households in Nigeria. Along the same line, Amao et al. (2017) adopted the Alkire-Foster method and a logit model in their study. The results revealed that household size, male headed household and dependency ratio significantly increased the probability of being poor in rural Nigeria while land ownership and non-agricultural income significant reduced it. However, living condition and education dimensions contributed the most while health and assets dimensions contributed the least to rural MPI in Nigeria. Michael, Tashikalma, Maurice and Tafida (2019) collected data through a multi-stage cluster sampling technique and analysed it using multidimensional Poverty Analytical Tool (MPAT) and a binary logistic regression. The results indicated that household size, age and marital

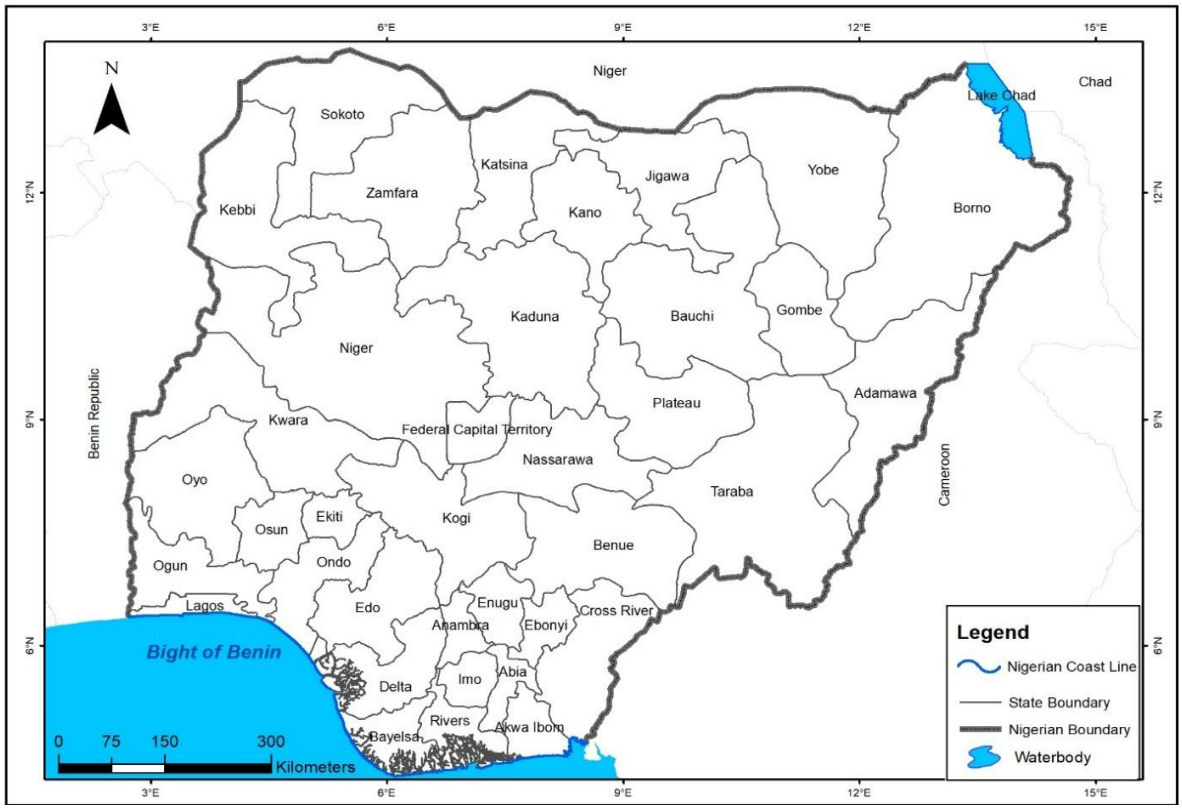
status negatively influenced MPI while gender, educational status, livelihood activities, farm size, livestock ownership, remittance, membership of group and access to credit positively influenced multidimensional poverty in rural Adamawa State, Nigeria. In a similar study using Alkire-Foster technique and a binary logit model, Oyekale et al. (2019) found that 69 percent of rural households in Ogun State were multidimensionally poor with infrastructure contributing the most to total deprivations. More so, household size, gender, off-farm income, availability of community health extension workers and availability of public market were found to significantly influence the poverty status of rural households in Ogun State, Nigeria. Adopting Alkire-Foster method, Israel, Hakim and Roslan (2015) revealed that approximately 82 percent of rural farm households are MPI poor in Oyo State, Nigeria. The binary logistic regression results showed that age, marital status, income, household head farming experience and number of dependants were significant determinants of multidimensional poverty among rural farm households in Oyo State. Usman (2018) adopted the Alkire-Foster technique and found 82 percent of rice farming households in northern Nigeria to be multidimensionally poor. The disaggregated results showed that nutrition, access to hospital and children's school enrolment indicators were the key contributors to multidimensional poverty among the rice farming households in the northern states. Using Alkire-Foster method, Ozughalu and Ogwumike (2018) found at least one-fifth of the Nigerian population to be multidimensionally energy poor with high concentration in the rural areas and northern Nigeria. The binary logistic regression results showed that age, gender, educational level of household head, region of residence and household composition were significant determinants of extreme energy poverty in Nigeria. Deinne and Ajayi (2018) employed the Geographical Information System (GIS), Principal Component Analysis (PCA) and ANOVA to analyse data obtained from 2521 households selected through stratified random sampling technique. The results show significant variations in the distribution of multidimensional poverty between senatorial districts in Delta State.

4. METHODOLOGY

4.1 Study area

Nigeria is located in the western region of Africa with a total area of 923, 768 km^2. It lies between latitude 4^0N and 14^0N and longitude 3^0E and 15^0E. It is bordered by the Republic of Benin in the west, Cameroon in the east, Niger Republic in the north and Gulf of Guinea in the south. It comprises 36 states and the Federal Capital Territory (see Figure 2) which are distributed across the 6 geopolitical regions. The most populous states are Kano (13,076,892) and Lagos (12,550,598) while the least populous are Bayelsa (2,277,961) and Ebonyi with an estimated population of 2,880,383 in 2016 (Central Bank of Nigeria − CBN, 2018). Nigeria has an estimated dependency ratio of 88 percent and average annual growth rate of 2.43 percent (National Bureau of Statistics − NBS, 2016). More so, an estimated 42 percent of the country's population are within the age of 0 − 14 years (UNDP, 2018). Currently, its population is estimated at 195,874,740 with a larger proportion living in rural areas (World Bank, 2019b). While agriculture remains the highest employer of labour contributing approximately 35 percent to total employment in 2019 (World Bank, 2019a), the petroleum sector constitutes the major source of foreign exchange earnings and revenue in Nigeria (KPMG, 2019; Iwilade, 2020).

Figure 2: Map of Nigeria showing the 36 states and the Federal Capital Territory



Source: Author's illustration using ArcGIS Desktop 10.4.1

4.2 Data sources

Data on variables in the model were obtained from various sources. For the MPI, the data were obtained from the OPHI. Data on total fertility rate, population and labour force were obtained from the database of NBS. In addition, data on state capital expenditure were obtained from StatiSense.

4.3 Model specification

To evaluate the determinants of multidimensional poverty across states, the study specifies a cross-sectional regression model as follows:

$$MPI_i = \beta_0 + \beta_1 lnTFTR_i + \beta_2 lnCEXP_i + \beta_3 lnLFRC_i + \varepsilon_i \quad (1.0)$$

Where β_0 is the intercept; β_1, β_2, and β_3 are the coefficients of the regressors; MPI is multidimensional poverty index used to proxy multidimensional poverty; lnTFTR is the natural log of total fertility rate; lnCEXP is the natural log of capital expenditure; lnLFRC is the natural log of labour force; ε is the stochastic term; and i is the subscript denoting each state. Model (1.0) is built on the structural theory of poverty. "The theory states that macro-level labour market and demographic conditions put people at risk of poverty, and cross-section and temporal differences in these structural factors account for variations in poverty" (Brady, 2009). While total fertility rate and labour force might be the key determinants of poverty, capital expenditure is controlled for to better explain variations in multidimensional poverty across states.

4.4 Definition of variables and a priori expectation

Table 3: Meaning of variables and a priori expectation

Variable	Definition	A priori expectation
MPI	The product of headcount (incidence) and intensity of multidimensional poverty. Its value falls between 0 and 1.	
Labour force	The population between 15 and 64 years who are willing and able to work.	Positive (−)
Total fertility rate	The average number of children a woman bears over her entire childbearing age (15 – 49).	Positive (+)
Capital expenditure	State spending on acquisition of fixed capital assets such as roads, schools, hospitals, et cetera.	Negative (−)

Table 3 shows the definition of each variable and theoretical expectations of the behaviour of parameter estimates in the regression model.

4.5 Estimating parameters in the MPI model

The parameters of the MPI model are estimated using the OLS technique. According to Asteriou and Hall (2007), the OLS estimators are obtained by minimizing the sum of squared residuals (RSS) – $\sum_{i=1}^{N} \varepsilon_i^2$ – in the model. The MPI model is specified as:

$$MPI_i = \beta_0 + \beta_1 lnTFTR_i + \beta_2 lnCEXP_i + \beta_3 lnLFRC_i + \varepsilon_i \quad (1.0)$$

Following Asteriou and Hall (2007), model 1.0 can be re-written in matrix form as:

$$MPI = X\beta + \varepsilon$$

$$MPI = \begin{pmatrix} MPI_1 \\ MPI_2 \\ \vdots \\ MPI_{37} \end{pmatrix}, \qquad X = \begin{pmatrix} 1 & lnTFTR_1 & \dots & lnLFRC_1 \\ 1 & lnTFTR_2 & \cdots & lnLFRC_2 \\ \vdots & \vdots & \cdots & \vdots \\ 1 & lnTFTR_{37} & \cdots & lnLFRC_{37} \end{pmatrix}$$

$$\beta = \begin{pmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_3 \end{pmatrix}, \qquad \varepsilon = \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_{37} \end{pmatrix}$$

Thus, MPI is 37 × 1 vector, X is 37 × 4 matrix, β is 4 × 1 vector and ε is 37 × 1 vector. In matrix notation, $RSS = \varepsilon'\varepsilon$. Thus we have:

$$RSS = (MPI - X\beta)'(MPI - X\beta) \quad (1.1)$$

$$= (MPI' - \beta'X')(MPI - X\beta) \quad (1.2)$$

$$= (MPI'MPI - MPI'X\beta - \beta'X'MPI + \beta'X'X\beta) \quad (1.3)$$

$$= (MPI'MPI - 2MPIX'\beta' + \beta'X'\beta) \quad (1.4)$$

Differentiate equation 1.4 with respect to β and set the result equal to zero:

$$\frac{\delta RSS}{\delta \beta} = -2X'MPI + 2X'X\beta = 0 \quad (1.5)$$

$$X'X\beta = X'MPI \quad (1.6)$$

Multiplying both sides by the inverse matrix $(X'X)^{-1}$ gives:

$$\beta = (X'X)^{-1}X'MPI \quad (1.7)$$

Assuming equation (1.0) satisfies the underlying assumptions of the classical linear regression model, β is the vector of Best Linear Unbiased Estimators (BLUE).

5. EMPIRICAL RESULTS AND DISCUSSION

5.2 ANOVA

Table 6: Results of ANOVA

Variable	$\sigma^2_{between}$	σ^2_{within}	F-value	P-value
MPI	0.2069	0.0052	39.48	0.0000

Note: $\sigma^2_{between}$ and σ^2_{within} are variances between and within geopolitical regions

Table 6.1: ANOVA homogeneity of variances test

Variable	Bartlett	Levene		
		W0	W50	W10
MPI	7.2358 (0.204)	2.9657 (0.0266)	1.6085 (0.1871)	2.9657 (0.0266)

Note: Probability values are presented in parentheses

Table 6.2: Tukey's pairwise test

MPI	Contrast
N/East vs N/Central	0.1932^{***}
	(0.0403)
N/West vs N/Central	0.2487^{***}
	(0.0387)
S/East vs N/Central	-0.1499^{*}
	(0.0424)
S/South vs N/Central	-0.1451^{*}
	(0.0403)
S/West vs N/Central	-0.1538^{***}
	(0.0403)
N/West vs N/East	0.0555
	(0.0403)
S/East vs N/East	-0.3431^{***}
	(0.0438)
S/South vs N/ East	-0.3383^{***}
	(0.0418)
S/West vs N/ East	-0.347^{***}
	(0.0418)
S/East vs N/West	-0.3987^{***}
	(0.0424)
S/South vs N/West	-0.3939^{***}

	(0.0403)
S/West vs N/West	−0.4025***
	(0.0403)
S/South vs S/East	0.0048
	(0.0438)
S/West vs S/East	−0.0039
	(0.0438)
S/West vs S/South	−0.0087
	(0.0418)

Note: Robust standard errors are presented in parentheses
*** P < 0.01; ** P < 0.05; * P < 0.1

Table 6 shows the results of ANOVA conducted to assess variations in the distribution of multidimensional poverty between geopolitical regions in Nigeria. The geopolitical regions are north-central (n = 7), north-west (n = 7), north-east (n = 6), south-east (n = 5), south-west (n = 6) and south-south (n = 6). Given that the probability value of the F-statistic is less than 0.01 critical value (P < 0.01), there are significant variations in multidimensional poverty between the geopolitical regions. Further, in Table 6.1, the Bartlett's test shows no significant differences in the variances of MPIs between regions. Also, the Levene's test corroborate the Bartlett's test of no significant differences in variances of the MPIs (P > 0.01), hence, validating the reliability of the ANOVA results. However, reverse is the case at 10% and 5% significance levels for the mean (W0) and trimmed mean (W10). In Table 6.2, the Tukey's test reveals significant variations in multidimensional poverty between regions in the south and the north and most sub-regions in the north. There are no significant variations in multidimensional poverty between sub-regions in the south.

5.3 Preliminary Analyses

Table 7.1: Results of descriptive statistics

Variable	Mean	Std. Dev.	C.O.V	Min	Max
MPI	0.225	0.182	80.889	0.01	0.538
lnTFTR	1.666	0.240	14.406	1.194	2.14
lnCEXP	4.286	0.658	15.352	3.215	5.950
lnLFRC	14.505	0.430	2.964	13.596	15.731

Note: Std. Dev., C.O.V, Min and Max denote standard deviation, co-efficient of variation, minimum and maximum, respectively.

Table 7.1 presents the statistics and behaviour of variables in the model. The mean measures the centre while the standard deviation and range (Max – Min) measure the spread of the distribution. For MPI, the coefficient of variation (standard deviation as a percentage of the mean) is 80.88 percent, indicating relatively high spread of data points around the mean. Similarly, for the regressors, lnCEXP has the highest C.O.V of 15.352 while lnLFRC has the least C.O.V. of 2.964.

7.2: Correlation matrix of variables in the MPI model

	MPI	lnTFTR	lnCEXP	lnLFRC
MPI	1.0000			
lnTFTR	0.9101	1.0000		
lnCEXP	−0.0773	−0.0913	1.0000	
lnLFRC	−0.5329	−0.4826	0.5336	1.0000

Table 7.2 shows the pairwise correlation matrix of variables in the regression model. The correlation co-efficient of MPI and lnTFTR is 0.9101, indicating high and positive linear relationship. On the contrary, coefficient -0.0773 indicates negative relationship between MPI and lnCEXP. Along the same line, the MPI and lnLFRC exhibits negative relationship. The correlation co-efficient of the regressors are moderate, thus indicating no threat of multicollinearity should they get plugged in the same model.

5.4 Estimated models

Table 8: Results of estimated MPI model

Variable	Coefficient
lnTFTR	0.6313^{****}
lnLFRC	-0.0779^{*}
lnCEXP	0.0267
Constant	0.1886
Observations	37
R-squared	0.846

Note: Robust standard errors are presented in parentheses
*** P < 0.01; ** P < 0.05; * P < 0.1

In Table 8, the OLS results show positive and significant relationship between MPI and TFTR. Conversely, LFRC has negative and significant effect on MPI. For capital expenditure, the effect on MPI is positive and insignificant, thus contradicting a priori expectation. Although statistically insignificant, the value of the constant, 0.1886, falls between the MPI theoretical value of 0 and 1. Assuming all the regressors are zero, 18.86 percent of the Nigerian population will be multidimensionally poor. In addition, the coefficient of determination (R^2), 0.846, implies that the regressors explain 84.6 percent variations in MPIs.

6. SUMMARY OF FINDINGS AND CONCLUSION

6.1 Summary of findings

The study finds significant variations in the distribution of multidimensional poverty between geopolitical regions in the country. The Tukey's test shows significant variations in multidimensional poverty between the south and the north and most sub-regions in the north. There are no significant differences in multidimensional poverty between sub-regions in the south. Further, the estimated model shows that total fertility rate is a positive and significant determinant of multidimensional poverty. On the contrary, the relationship between labour force and multidimensional poverty is negative and significant. Although positive, capital expenditure has no significant effect on multidimensional poverty in Nigeria.

6.2 Conclusion

There is uneven development between geopolitical regions in the country, with states in the north, on the average, having the highest proportion of multidimensionally poor people and the least developed.

Capital expenditure has the tendency to contribute to multidimensional poverty in Nigeria. This paradoxical situation signals poor government spending on health, education and other critical infrastructure in rural areas and acute deprivation of rural households that account for a larger proportion of the country's population. If left unaddressed, increasing capital expenditure without

careful consideration of its accessibility by the majority will worsen poverty in the country. In addition, fertility rate contributes significantly and the most to multidimensional poverty in the country. With a population of approximately 193,392,517 (CBN, 2018) and 51.4 percent in multidimensional poverty (UNDP, 2019) in 2016, an increase in fertility rate will translate to enormous increase in multidimensionally poor population. This has potential adverse effect on the country's growth and development. However, this does not imply that households across states should not reproduce in order to keep multidimensional poverty from rising. It does mean that government at all levels should invest enormously in reproductive health and education in order to raise households' awareness, access reproductive health services easily and consequently lower fertility rate.

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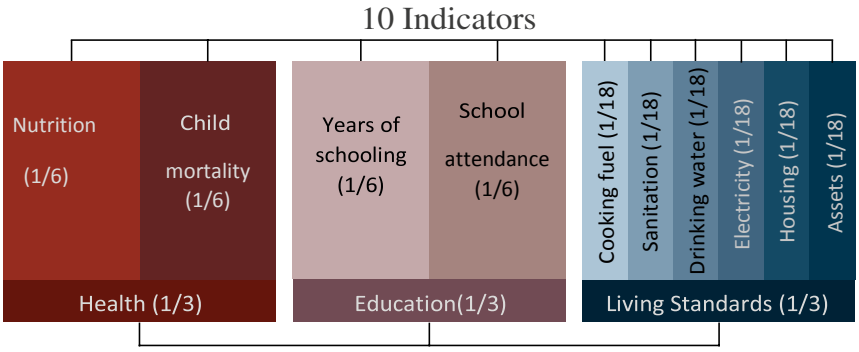
Appendix 1

Figure A1. Structure of the Global MPI



Source: OPHI, 2018

Appendix 2

Table A1: Global MPI[2] in Nigeria − 2016

Area	*M PI*	*H*	*A*	Vulnerable	Severe Poverty	Population Share
National	0.294	52.0%	56.7%	16.9%	32.7%	100.0%
Urban	0.114	23.9%	47.8%	19.6%	9.2%	33.5%
Rural	0.385	66.1%	58.3%	15.5%	44.5%	66.5%

Source: OPHI, 2018

[2] $MPI = H \times A$, reflecting both the share of people in poverty and the degree to which they are deprived.

Appendix 3

Table A2: Global MPI in Nigeria by subnational region − 2016

Region	MPI	*H*	*A*	Vulnerable	Severe Poverty	Population Share
Abia	0.043	10.7%	39.9%	21.8%	0.5%	1.0%
Adamawa	0.323	59.9%	53.9%	17.0%	28.1%	2.4%
Akwa Ibom	0.092	22.9%	40.3%	23.1%	2.6%	2.2%
Anambra	0.038	9.2%	41.5%	16.6%	1.3%	1.7%
Bauchi	0.504	81.3%	61.9%	9.4%	56.2%	4.9%
Bayelsa	0.103	24.3%	42.2%	25.8%	2.6%	0.7%
Benue	0.183	39.9%	46.0%	30.7%	9.4%	2.7%
Borno	0.337	64.0%	52.7%	20.0%	25.7%	6.2%
Cross River	0.120	28.1%	42.7%	30.4%	2.6%	1.8%
Delta	0.055	13.4%	40.6%	20.2%	0.4%	1.6%
Ebonyi	0.170	38.9%	43.8%	35.2%	6.5%	1.3%
Edo	0.021	5.6%	36.8%	14.3%	0.0%	1.3%
Ekiti	0.055	14.1%	38.9%	21.2%	0.4%	0.6%
Enugu	0.039	10.3%	37.6%	20.5%	0.0%	1.3%
FCT Abuja	0.118	25.0%	47.1%	20.0%	6.7%	0.8%
Gombe	0.458	77.4%	59.2%	11.8%	46.3%	1.8%
Imo	0.036	9.6%	37.1%	19.7%	0.2%	1.8%
Jigawa	0.533	83.3%	64.0%	10.3%	62.1%	4.4%
Kaduna	0.296	56.7%	52.1%	15.4%	24.9%	5.8%
Kano	0.401	68.8%	58.4%	15.4%	39.9%	7.6%
Katsina	0.464	77.5%	59.9%	12.6%	47.2%	6.1%
Kebbi	0.493	79.1%	62.4%	10.6%	55.0%	3.0%
Kogi	0.136	32.1%	42.4%	26.2%	4.5%	1.7%
Kwara	0.147	30.2%	48.5%	23.1%	10.2%	1.5%
Lagos	0.010	2.4%	42.0%	12.3%	0.3%	4.1%
Nasarawa	0.276	54.3%	50.8%	25.3%	19.4%	2.1%
Niger	0.364	61.6%	59.0%	15.7%	36.2%	4.4%
Ogun	0.059	13.2%	44.6%	21.2%	2.7%	1.3%
Ondo	0.087	20.3%	42.7%	23.2%	2.5%	1.9%
Osun	0.046	11.3%	40.5%	25.2%	0.8%	1.7%
Oyo	0.111	22.0%	50.7%	19.4%	7.4%	2.9%
Plateau	0.282	54.9%	51.5%	20.0%	19.2%	3.7%
Rivers	0.029	7.3%	40.2%	16.2%	0.6%	2.1%
Sokoto	0.538	86.1%	62.5%	7.3%	59.7%	2.9%
Taraba	0.337	65.1%	51.8%	20.6%	24.1%	1.6%
Yobe	0.491	81.7%	60.1%	9.5%	54.4%	3.1%
Zamfara	0.522	82.7%	63.2%	9.1%	57.9%	4.2%

Source: OPHI, 2018