International Journal of Basic, Applied and Innovative Research

RESEARCH PAPER

CENSORED FOSTER GREER THORBECKE (FGT) INDEXES IN POVERTY ANALYSIS IN NIGERIA

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ABSTRACT

This study is an attempt to assess the prospects of censoring in one-dimensional poverty analysis in Nigeria. The conventional method involves truncation of the non-poor households and this often leads to measurement error. Censoring instead of truncation was considered using data from the Nigeria General Household Survey (NGHS) Panel Survey. The estimated poverty indices obtained via censoring gave higher precision estimates compared to the indices obtained traditionally. This finding implies that censoring could reduce the problem of measurement error involved in the traditional poverty analytical procedures.

Key words: Censoring, Measurement error. One-dimensional, Poverty analysis, Poverty indices

INTRODUCTION

Poverty is defined ''relative to the standard of living in a society at a specific time'' (Scottish Poverty Information Unit, 2016). Osowole et al (2018) described poverty as limitation in some dimensions. Awa (1983) saw poverty as the condition of insufficient financial or material possession. World Bank (1999) further described poverty as a violation of human dignity and inability to make choices. This is not unsimilar to Ajakaiye and Olomola (1999) who opined that a living condition where living entities are faced with economic, social, political, cultural and environmental deprivations is termed poverty. In 2002, the World Bank again defined poverty as the ''inability to attain a minimum standard of living'' relative to a given society. Some other studies on poverty include Aigbokhan (1998); Okojie et al (1999); Alayande and Alayande (2004); Oni and Yusuf (2006); and Oyekale and Oyekale (2007).

The reality now is that Nigeria is bedeviled by the menace of poverty (Ajakaiye, 2002). This situation is so worrisome in many Nigerian households today and is a cause for concern by all. This critical situation is supported by past studies of the Federal Office of Statistics (1996) now the National Bureau of Statistics (NBS), Ojo (2008) and Abiola and Olaopa (2008). These studies noted that the ''scourge of poverty in Nigeria is an incontrovertible fact, which results in hunger, ignorance, malnutrition, disease, unemployment, poor access to credit facilities and low life expectancy as well as general level of human hopelessness''.

The traditional approach in a poverty study is to focus only on the poor households. This is actually a truncation procedure since non-poor households have been excluded. The prospect of censoring, a procedure that allows non-poor households to be retained in a poverty analysis has not been explored extensively. This study attempts therefore this prospect and it is hoped that this approach will help in reducing errors that may be associated with the poverty line.

METHODOLOGY

The secondary data used for numerical illustration in this study were obtained from the National Bureau of Statistics (NBS). The dataset was the 2012 Nigeria General Household (GHS) Panel data with 22,000 households. This dataset was used in an earlier study of Osowole et al (2016). The authors assessed the basic dimensions of poverty to choices of the poverty line in Nigeria. This dataset was used for this study in line with the suggestion of Osowole et al (2018) who opined that comprehensive data that will make identification of the poor easy should be sought in any poverty study.

Poverty Measures (Indices): Poverty is generally measured via proxies. One common proxy used in Africa is consumption expenditure. A major step in poverty analysis is the identification of those that may be termed ''poor'' and the aggregation of information on them to obtain an index of poverty. A threshold level is often calculated based on the selected proxy. Any household with per capita expenditure below this threshold (i.e. the poverty line) is deemed to be poor; otherwise it is non-poor. Foster, Greer and Thorbecke (1984) proposed a generalized class of one-dimensional poverty measures known as the FGT P_α poverty measures defined as

$$P_\alpha = \int_0^z \left(\frac{z-y_i}{z}\right)^\alpha f(y)dy \qquad (1)$$

Where $\alpha \geq 0, y \geq 0$
y_i is the per capita expenditure for household i.
z is the poverty line generally calculated as $\frac{2}{3} mean\ per\ capita\ expenditure$
α is the poverty aversion index with possible values 0, 1 and 2
$f(y)$ is any hypothesized consumption expenditure distribution

Per capita expenditure $= \dfrac{\text{Total household expenditure}}{\text{Household size}}$

Types of Poverty Measures: Poverty analysis usually focuses on indexes that are influenced by the number of people below the poverty line, the poverty gap and the distribution of expenditure among the poor. These three poverty dimensions are usually defined in literature as the three I's of poverty (Jenkins and Lambert, 1997).

Incidence of Poverty Index: This is obtained from (1) above by setting $\alpha = 0$. That is:

$$P_0 = \int_0^z \left(\frac{z-y_i}{z}\right)^0 f(y)d(y) \qquad (2)$$

The equation reduces to $P_0 = \frac{M}{N}$, that is the ratio of the number of poor households in the population to the total number of households in the sampled population. This is a commonly used measure known as the incidence of poverty or the headcount ratio or when turned into a percentage, the headcount index (i.e total proportion of households whose expenditure is not up to the poverty line).

Intensity of Poverty Index: This is obtained from (1) by setting $\alpha = 1$. That is:

$$P_1 = \int_0^z \left(\frac{z-y_i}{z}\right)^1 f(y)d(y) \qquad (3)$$

This is generally called the poverty gap index and is also known as the depth of poverty index. It shows the short fall of the poor's expenditure from the poverty line expressed as an average of all the households in the sampled population.

Severity of Poverty Index: This is obtained from (1) by setting $\alpha = 2$. That is:

$$P_2 = \int_0^z \left(\frac{z-y_i}{z}\right)^2 f(y)d(y) \qquad (4)$$

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This is called the poverty severity index. It is known also as the square poverty index. It is influenced by the distribution of living standards among the poor and may account for the variations in their welfare distribution.

Censored Foster-Greer-Thorbecke (FGT) Indices: When censoring is used in poverty analysis, the poverty measures (indexes) are termed Censored Foster-Greer-Thorbecke (FGT) Indices obtained by changing the expenditures of all households greater than the poverty line with the value of the poverty line obtained from the formula:

$$Z = \frac{2}{3} \text{average per capita expenditure}$$

This approach is expected to reduce the measurement error associated with the removal of the non poor households. The censored FGT poverty indices are given below in (5)

$$P_\alpha^* = \int_z^\infty \left(\frac{z - y_i^*}{z}\right)^\alpha f(y)d(y) \qquad (5)$$

We note that the censoring approach being proposed in this study has receive little attention in studies on one-dimensional poverty analysis in Nigeria.

Bootstrapping: This technique is used to obtain some basic descriptive statistics (mean, variance and precision) for poverty indices considered in this study. It is a technique that is often used to handle quantities that do not have flexible algebraic tendencies. It is often seen as a resampling method and has been applied extensively by researchers in diverse fields. The pioneer of bootstrapping is is Bradley Efron (Efron, 1982). An application of this method in one-dimensional poverty analysis had been undertaken previously by Osowole and Bamiduro (2012) where the authors employed the technique in their quest to find approximate density functions for the basic FGT poverty indices.

RESULTS

Estimation of Poverty incidence, intensity and severity: The estimates of the incidence of poverty, intensity and severity using P_0, P_1 and P_2 respectively are shown in Table 1. The poverty line ($z = \frac{2}{3}$ average per capita expenditure) was estimated as N73989.9.

Table 1: Estimates of poverty incidence, intensity and severity

Dimension of Poverty	Index of Poverty	Estimate
Poverty incidence	P_0	0.4116
Poverty intensity	P_1	0.1345
Poverty severity	P_2	0.0594

Estimation of Censored Poverty incidence, intensity and severity: The estimates of the censored incidence of poverty, intensity and severity using P_0^*, P_1^* and P_2^* respectively are shown in Table 2 for the poverty line ($z = \frac{2}{3}$ average per capita expenditure) estimated as N73989.9.

Table 2: Estimates of Censored poverty incidence, intensity and severity

Dimension of Poverty	Index of Poverty	Estimate
Poverty incidence	P_0^*	0.1365
Poverty intensity	P_1^*	0.0309
Poverty severity	P_2^*	0.0109

Estimation of Bootstrap Descriptive Statistics for Poverty incidence, intensity and severity: The estimates of the bootstrap descriptive statistics (mean, variance and precision) for incidence of poverty, intensity and severity respectively are shown in Table 3

Table 3: Estimates of Bootstrap Statistics for poverty incidence, intensity and severity

Dimension of Poverty	Index of Poverty	Estimate	Mean	Variance	Precision
Poverty incidence	P_0	0.4116	0.411	0.000081	12408.996
Poverty intensity	P_1	0.1345	0.134	0.000014	73679.097
Poverty severity	P_2	0.0594	0.059	0.0000044	226963.462

Estimation of Bootstrap Descriptive Statistics for Censored poverty incidence, intensity and severity: The estimates of the bootstrap descriptive statistics (mean, variance and precision) for censored incidence of poverty, intensity and severity respectively are shown in Table 4.

Table 4: Estimates of Bootstrap Statistics for Censored poverty incidence, intensity and severity

Dimension of Poverty	Index of Poverty	Estimate	Mean	Variance	Precision
Poverty incidence	P_0^*	0.1365	0.136	0.000039	25957.384
Poverty intensity	P_1^*	0.0309	0.031	0.0000033	306017.991
Poverty severity	P_2^*	0.0109	0.011	0.000000076	1313551.900

DISCUSSION

One-dimensional poverty analysis based on a single proxy like expenditure as used in this study generally involves truncation. The conventional approach is to truncate (remove) the non-poor households from the population of households and the remaining poor households are used for further analysis. This removal often leads to measurement error which may invalidate the results of the analysis. This is corroborated by Takayama (1979) who observed that complete information on poverty is lost when the distribution of the households has been truncated by excluding the non-poor households. The censored distribution is obtained when expenditures of the non-poor households are substituted with the value obtained as the poverty line.

The estimates of the dimensions of poverty for the truncated and censored distributions of households decreased as the poverty aversion index (α) increased from 0 to 2 (Tables 1 and 2). This is the expected pattern in one-dimensional poverty analysis.

The bootstrap descriptive statistics estimates for the three dimensions of incidence, intensity and severity for both truncated and censored households show that the indices P_0, P_1 and P_2 are unbiased. This is also true for P_0^*, P_1^* and P_2^*. The reason for this is that the averages as estimated in Tables 4 and 5 are approximately equal to the estimates obtained for the indices originally. Precisions from the censored indices are higher than the ones obtained for the truncated households. This indeed confirms the suitability of censoring in one-dimensional poverty analysis. This fact was captured succinctly by Takayama (1979) who opined that a poverty distribution should be augmented by censoring.

CONCLUSION

This study attempted to assess the prospect of censoring in poverty analysis in Nigeria. The censoring procedure was found suitable in the study because it gave higher precisions for the poverty indices obtained via the procedure of bootstrapping. Thus, this method may indeed reduce the problem of measurement error which can make results from the conventional method defective.

REFERENCES

Abiola, A.G. and Olaopa, O.R. (2008). Economic Development And Democratic Sustenance in Nigeria: In E.O. Ojo (ed), Challenges of Sustainable Democracy in Nigeria (pp. 25-34). Ibadan: John Archers Publishers Limited.

Aigbokhan B. E. (1998). Poverty growth and inequality in Nigeria: A case study. Final report submitted to the African Economic Research Consortium, December.

Ajakaiye ,D.O and Olomola, A.S (1991) Conceptual and Methodological issues in Poverty Alleviation. Bulletin of the Central Bank Nigeria Vol 23, No 4.

Ajakaiye, O. (2002). Overview of the Current Poverty Eradication Programme in Nigeria.

Alayande B. and Alayande O. (2004). A quantitative and qualitative assessment of vulnerability to poverty in Nigeria: A paper submitted for presentation at the CSAE conference on poverty reduction, growth and human development in Africa, March.

Awa, E.O. (1983). Teaching Political Science in African Universities: A Problem Solving Approach. United Kingdom: Zed Press Plc.

Efron, B.(1982). The Jacknife, the Bootsrap, and other Resampling Plans. Philadelphia: SIAM

Federal Office of Statistics (1996). The Social and Economic profile of Nigeria. Abuja: Federal Office of Statistics.

Foster, J., J. Greer, and E. Thorbecke, E (1984). A Class of Decomposable Poverty Measures, Econometrica, Vol. 52, No. 3: 761-766.

Jenkins, S. P. and Lambert, P. J. (1997) Three ′I′s of poverty curves, with an analysis of UK poverty trends. Oxford Economic Papers, 49: 317–327.

Ojo, E.O. (2008). Imperatives of Sustaining Democratic Values. In Ojo, E.O (ed), Challenges of Sustainable Democracy in Nigeria (pp, 3-24). Ibadan: John Archers Publishers Limited.

Okojie C., Ogwumike F.O., Anyanwu C. and Alayande B.A. (1999). Poverty in Nigeria: Gender, dimension, access to social services and labour market Issues. Interim report submitted to the African Economic Research Consortium, Nairobi.

Oni A. O. and Yusuf S.A. (2006). Determinants of expected poverty among rural households in Nigeria. Final report presented at the AERC Biannual Workshop in Nairobi, Kenya, December.

Osowole, O.I. and Bamiduro,T.A,(2012). On the Probabilty Density Function of Forster-Greer-Thorbecke (FGT) Poverty Indices. West African Journal of Industrial and Academic Research, Vol. 4(1): 9-15

Osowole, OI, Bamiduro,TA,Nwaka, RN and Adeniyi, OS(2016). Assessment of the Basic Dimensions of Poverty to Choices of the Poverty Line in Nigeria, African Journal of Science and Research, 5(4): 9-13

Osowole, O.I., Awomokun, G., Nwaka, R.N. and Balogun, K.O. (2018). Proxy Means Test (PMT) Analysis of Poverty in Oyo State. International Journal of Basic, Applied and Innovative Research, 7(3): 62-67

Oyekale A. and Oyekale T. (2007). An assessment of income shocks and expected poverty dynamics in Nigeria. Department of Agricultural Economics, University of Ibadan, Nigeria. https://goo.gl/MyQwPA

Takayama, N. (1979). 'Poverty, Income Inequality, and Their Measures: Professor Sen's Axiomatic Approach Reconsidered'. Econometrica, 47(3):747-759.

World Bank. (1999). World Development Report 1999/2000: Attacking Poverty. Washington, DC: World Bank.
World Bank. (2002). "Empowerment and Poverty Reduction: A Sourcebook." PREM, World Bank, Washington, DC.

AUTHORS' CONTRIBUTION

The authors Osowole, OI, Ajibola, J., Nwaka, RN and Balogun, KO were involved in different stages of the research from the conceptualization of the research topic to the final draft of the manuscript.