Income Bipolarization and Poverty: Evidence from Rural Nigeria

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Abstract: The disappearance of the middle class- income bipolarization could result into tension and social conflict. If such conflict starts in the rural area, the possible resulting revolts would clog the wheel of economic production and policy implementation and there is possibility of spreading to the urban area. The study therefore estimated income bipolarization in the rural area of Nigeria from 1980 to 2004 using Foster-Wolfson –FW- (1994) and Lasso de le Vega and Urrutia – LU- (2006) indices. Bipolarization linked poverty was estimated for the periods through the later and Foster-Wolfson bipolarization estimates were linked with the poverty status and other socio-economic features of the rural households by tobit regression analysis. Bipolarization was found to be on reduction from 1992 to 2004 moving in the direction of poverty level. FW Bipolarization was 0.6125, 0.4067, 0.4775, 0.4108 and 0.3529 in 1980, 1985, 1992, 1996 and 2004 while LU Bipolarization was 0.1676, 0.1430, 0.1610, 0.1460 and 0.1383 for the same years respectively. Poverty has highest significant positive effect on bipolarization with a marginal effect of 0.02520. The marginal effects of age was 0.00014, female head households was 0.00119. Household size, father's education, mother education, married status, farming and wage employment have significant negative marginal effects of 0.00037, 0.00027, 0.00013, 0.00636, 0.000697 and 0.00105 respectively. Income bipolarization is higher among households located in the South than their base category, the north. Poverty and its covariates have higher sum total interactive positive effect on bipolarization than their base categories, the non-poor covariates. There is need to reduce poverty for bipolarization to decline. The southern part needs more attention in bipolarization reduction strategies. All variables that reduce poverty like education would have to be harnessed further to reduce bipolarization to guide against the occurrence of its consequences.
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1. Introduction

Income distribution analysis is a phenomenon that has attracted the attention of researchers in recent times and the importance of income becomes more apparent as poverty is characterized by low income. Income refers to consumption opportunity gained by an entity (household) within a specified time frame, which is generally expressed in monetary terms (Wikipedia, 2008). Radwan (2008) reported that about 90 percent and 70 percent of Nigerians live on less than US$2 and US$1 per day respectively implying 10 percent living on US$2 and above. This somehow indicates that income in Africa and Nigeria in particular, is not evenly distributed; some are in the lower part, some in the middle class and the remaining in the upper class. NBS (2007) mentioned that it is clear that high rate of poverty and income inequality have threatened the Nigerian middleclass with extinction; creating doubt about the relevance and impact of most macroeconomic reforms of the past. If the distribution is at either side of the divide, lower or upper class with the middle class shrinking or becoming extinct, such income distribution is said to exhibit polarization. (Vander puye-Orgle, 2002; Chakravarty and Majumder, 2001; Rodriguez, 2006).

According to Chakravarty and Majumder (2001), income polarization is the decline of the middle class and is of two types: The first type is if a distribution is more spread out from the middle position to the tails, thus increasing the distance between two groups below and above the median income level (polarization). And the second type is increased bipolarity (bipolarization) where incomes below or above the middle position become closer to each other as shown in figure 1, which we have decided to measure in this study as a matter of choice and for us to bring in the concept of poverty which still remain a problem in Nigeria. Therefore polarization engenders clustering of the elements in the income distribution at polar modes. This markedly shows that income polarization is quite different from income inequality another feature in income distribution analysis which means how the element spread out from the mean or median which is overall dispersion of the distribution.

Considering an income distribution continuum of $x = (x_1, \ldots, x_n)$ where x_i is the positive income level of the ith person and $m(x)$ is the median income of x as shown in figure 1. The figure shows polarization increasing movement which is increased bipolarization and it occurs when income levels below
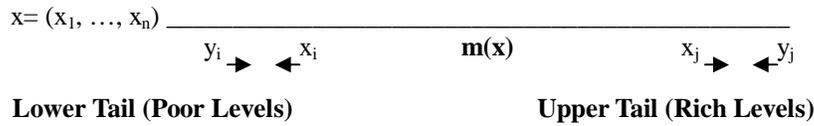
$$x = (x_1, \ldots, x_n)$$

$y_i \rightarrow \quad \leftarrow x_i \qquad\qquad m(x) \qquad\qquad x_j \rightarrow \quad \leftarrow y_j$

Lower Tail (Poor Levels)   **Upper Tail (Rich Levels)**

Figure 1. Increased Bipolarization (Inferred from Wang and Tsui, 2000)

or above m(x) move closer to each other; bipolarization will increase if y_i and x_i below and y_j and x_j above m(x) move closer to each other. y_i and x_i below and y_j and x_j above m(x) become identify with reducing inequality, that is, increasing identity but increase alienation between those below and above m(x). The distribution therefore features poor and rich groups (Esteban and Ray, 1994). An individual eventually falls into either of the groups; the distribution exhibiting a population that is either rich or poor with very small or no middle class bridging the gap between the two.

Presently, Nigeria economy is driven by agriculture and is rural based employing large proportion of her labour force with about 70% of the population (NBS, 2005) in the rural area and the sector was reported to have the highest contribution of 41.84% to her GDP in the year 2009 (NBS, 2010). If income distribution is therefore polarized in the rural area, the possible tension and social conflict that could arise will disrupt rural production and spill over to urban sectors with serious strikes, demonstrations, processions and revolt which Duclos, Esteban and Ray (2004) identified as consequences of polarization with implications for sustainability of policy implementation (Aigbokhan, 2000).

In spite of the relevance of income bipolarization, literature on it is very lean and mush is still needed to be done and reported (Wang and Tsui, 2000) and the situation is not different in Africa. This study adds to the available literature on income polarization in Nigeria and Africa which include that of Aigbokhan (2000), Vanderpuye-Orgle (2002) and Awoyemi et al (2006). The study therefore adopted Foster Wolfson (1994) (FW) and Lasso de la Vega and Urrutia (LU) as demonstrated by Duclos Esteban and Ray (2008), and Rodriguez (2006) respectively to measure income bipolarization over some years due to available software and relative ease in their computation. With LU, bipolarization was linked with poverty.

The linkage of bipolarization and poverty is desirable due to the fact that poverty level is high in Nigeria with poverty incidence of 54.5% in 2004 while it was 43.2% and 63.3% in urban and rural areas respectively (NBS, 2004). It is therefore worth measuring income bipolarization between the poor people and the rest of society and to make policy makers aware of the possible social conflict which could be measured by the bipolarization index due to

poverty (Rodriguez, 2006). Hence the use of LU bipolarization linked poverty to establish if the rural income distribution poses a danger of social conflict in Nigeria. Consequently, the paper is aimed at addressing the pattern of bipolarization in the rural sector of Nigeria over the period 1980 to 2004, the linkage between bipolarization and rural poverty, and households' socio-economic characteristics which include their poverty status through regression. Many studies including Nnadi and Nnadi (2009) applying regression analysis often capture socio-economic features and we hypothesize that there is no significant relationship between the characteristics and bipolarization.

2. Methodology

The geographical area of this research is the rural area in Nigeria. The sample frame is all the rural households enumerated by NBS in 1980, 1985, 1992, 1996, and 2004. The same research design was used by NBS to get the five sets of data. Therefore, secondary data of the four national consumer surveys done in 1980/81, 1985/86, 1992/93 and 1996/97 by the Federal Office of Statistics (rechristened National Bureau of Statistics, NBS) were used and that of year 2004 Nigeria Living Standard Survey. The complete household level survey data set were used and were extracted from diskettes obtained from NBS. It should be noted that the surveys were done with the assistance of the World Bank and British Council (NBS, 2004). These data sets were use by NBS (2004, 2005) to analyze the published poverty profile in Nigeria. Normalized real per capita consumption expenditure of the households was used as proxy for income and analyzed as follows:

The pattern of bipolarization among the rural households:

a) Foster-Wolfson (1994) index and Lasso de la Vega and Urrutia bipolarization index were used.

i) The Foster-Wolfson index (FW) (1994) is based on the Lorenz curve and it is derived from the Gini-Coefficient and it was demonstrated by Duclos, *et al* (2008) as

$$FW(k) = 2\left[2[0.5 - L(k, 0.5)] - I_2(k)\right] \frac{\mu(k)}{Q(k, 0.5)}$$

$$\ldots\ldots\ldots\ldots (1)$$

$$= \frac{\xi(k;\rho=2)-2GL(k,p=0.5)}{Q(k,p=0.5)} \qquad \text{......... (2)}$$

Where:

( ) = The Gini social welfare Index
GL(p) = The Generalized Lorenz Curve
Q(p) = The Quantile function
$I_2(k)$ = The Gini index of inequality

We use equation (1) because Gini social welfare index was not reckoned with.

ii) Lasso de la Vega and Urrutia bipolarization index as demonstrated by Rodriguez (2006) is given as

$$P^{LU}(X;\alpha,\beta) = \begin{bmatrix} \Pi_1^\alpha (1-G_1)^\beta + \\ \Pi_2^\alpha (1-G_2)^\beta \end{bmatrix} G_h^B(x) \qquad \text{.............. (3)}$$

where,

h = income that separate the income distribution into two different income groups

if h = m, the median income Equation (3) becomes

$$P^{LU}(X;\alpha,\beta) = \left(\frac{1}{2}\right)^\alpha \begin{bmatrix} (1-G_1)^\beta + \\ (1-G_2)^\beta \end{bmatrix} G_m^B(x) \qquad \text{.............. (4)}$$

where,

x = $x_1, \ldots, x_n$ = income levels
x_i = the income of the ith household
m = median income
Π_i = percentage of the population of group i
Π_i^α = *the identification term*

  = 1 or 1.6 = importance of group identification
$\beta \geq 0$ = the degree of sensitivity towards group cohesion
$\Pi_i^\alpha (1-G_i)^\beta$ = Identification term of group i
i = 1, 2
G^B = Between groups Gini-coefficient

Moreso, bipolarization was linked with poverty using Rodriguez (2006) approach. Accordingly, if poverty line, z, is the income level that divides the income distribution in two groups, the bipolarization between poor people and others is explicitly based on a poverty index and LU bipolarization index is a function of the normalized poverty deficit index of Foster-Greer-Thorbecke (FGT) as stated here-under.

$$P^{LU}(X;\alpha,\beta) = \begin{bmatrix} \Pi_1^\alpha (1-G_1)^\beta + \\ \Pi_2^\alpha (1-G_2)^\beta \end{bmatrix} \begin{bmatrix} T_Z^{FGT}(x;1) + \\ \frac{\Pi_1 \mu_1}{\mu}\left(\frac{\mu-Z}{Z}\right) \end{bmatrix}$$

$$\text{............... (5)}$$

$$T_Z^{FGT}(x;\gamma) = \text{product of headcount and income gap ratio}$$

$$T_M^{FGT} = T_Z^{FGT}(x;\gamma) = \frac{1}{N}\sum_{i=1}^n \Gamma(x_i)^\gamma \text{............(6)}$$

$$\text{.................... (6)}$$

$$\Gamma(x_i) = \max\left[\frac{Z-x_i}{Z};0\right] \qquad \text{............. (7)}$$

where, FGT = Foster-Greer-Thorbecke family of poverty measure

  γ = FGT parameter = 1
  x_i = income of the ith household
  x = the household distribution, $x_1, x_2, \ldots, x_n$
  n = number of households below the poverty line, Z
  N = the total sample population
  Z = poverty line (2-3rd of mean income)
  μ = mean income of the total population distribution.
  μ_1 = mean income of the poor in x-distribution below Z

This family of poverty measures is the normalized poverty deficit index or the product of the headcount and income gap ratios, $D_Z(x)/Z = {}_1I_Z(x)$, when $\gamma = 1$, ${}_1 = q/n$ and $I_Z(x)$ is the income gap ratio. The model, equation 5, is sensitive to incidence of poverty and its intensity because $\gamma = 1$. Rodriguez (2006) mentioned that it might be more suitable to use the poverty line to measure income bipolarization instead of using the median or mean incomes to divide the income distribution into two groups. By this, bipolarization and poverty measures are closely related, capturing normalized poverty deficit index as bipolarization is between the poor and the non-poor in the income distribution.

Finally, using 2004 data point, households' poverty status and bipolarization were considered using tobit regression with covariance analysis approach because most of the regressors are dummy variables. We generated FW bipolarization estimates for all the Thirty Six States of the Country. The estimate per state was then adopted for all households in that State as their bipolarization indices. This is because bipolarization estimate cannot be directly measured for each household and the household bipolarization estimate of the entire rural households was used as dependent variable against their poverty status as poor and non-poor households based on the two-third

poverty line and other socio-economic variables as shown below. The lowest and highest bipolarization estimates were used as the lower and upper limits for the tobit application using Stata 10.1. The tobit equation is as follows:

$$Y_i^* = \beta X_i + \varepsilon_i$$ ……… (8)

For , $Y_i = Y^*$ if $Y^* > T$

Y^* if $Y^* \; T$

Assuming $T = 0$

Thus $Y_i =$ Y^* if $Y^* > 0$ or

0 if $Y^* \; 0$

If $Y_i^* = Y$, then

$Y = f(X_i, d_i)$ ……. (9)

Where, $i = 1, 2, …, n$

Y = Bipolarization, Continuous variable

X = Socioeconomic Variable

d = Dummy socioeconomic variable (some will be additive while some will be multiplicative).

$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \alpha_1 d_1 + \alpha_2 d_2 + \alpha_3 d_3 + \alpha_4 d_4 + \alpha_5 d_5 + \alpha_6 d_6 + \alpha_7 d_7 + \alpha_8 d_8 + \alpha_9 d_9 + \alpha_{10} d_{10} + \alpha_{11} d_1 d_2 + \alpha_{12} d_1 d_3 + \alpha_{13} d_1 d_4 + \alpha_{14} d_1 d_{5+} \alpha_{15} d_1 d_6 + \alpha_{16} d_1 d_7 + \alpha_{17} d_1 d_8 + \alpha_{18} d_1 d_9 + \alpha_{19} d_1 d_{10} + \alpha_{20} d_1 x_1 + \alpha_{21} d_1 x_2 + \alpha_{22} d_1 x_3 + \mu$ ……… (10)

Where,

Y_1 = Income Bipolarization of household $i = 1$

X_1 = Age (in years)

X_2 = Household Size (number of individual in each household)

X_3 = Fathers' Education (Years)

X_4 = Mothers' Education (Years)

d_1 = Household poverty Status (Poverty Dummy: 1 = poor, 0 = Non Poor)

d_2 = Gender (Female Dummy: 1 = female, 0 = male)

d_3 = Marital Status (Married Dummy: 1 = Married, 0 = otherwise)

d_4 = Religion Status (1 = Christian/Muslim, 0 = otherwise)

d_5 = Occupational Group (Farming Dummy: 1 = Farming, 0 = Non Farming)

d_6 = Membership of Socio Group (Membership Dummy: 1 = Membership, 0 = Non Membership)

d_7 = Retired Age (1 = Minimum of 60 years-Retired, 0 = below 60 years- Active age)

d_8 = Wage employment (Wage Dummy: 1 = Wage employment, 0 = Non Wage employment)

d_9 = Geographical location (South Dummy: 1 = South, 0 = North)

d_{10} = Credit status (Credit Access Dummy: 1= Access to Credit, 0 = No Access to credit)

Interactive Dummies = $d_1 d_2$, $d_1 d_3$, $d_1 d_4$, $d_1 d_5$, $d_1 d_6$, $d_1 d_7$, $d_1 d_8$, $d_1 d_9$, $d_1 d_{10}$, $d_1 x_1$, $d_1 x_2$, $d_1 x_3$,

All coefficients of $d_1, d_2, ……, d_{10}$ (that is $\alpha_1, …, \alpha_{10}$) are differential intercepts coefficients because they tell us by how much the mean value of bipolarization indices of the dummy category that receives the value

of 1 differs from the intercept coefficients of the bench mark category, the category that receives the value of 0.

$\alpha_1, …, \alpha_{10}$ = Differential effects of the respective dummy variable (or Differential Intercepts Coefficients)

$\alpha_{11}, …, \alpha_{19}$ = Differential effects of the interaction dummies in multiplicative form (or Differential Slope Coefficients)

$\alpha_{20}, …, \alpha_{22}$ = Differential Slope Coefficients or Slope Drifter.

$\beta_1, …, \beta_4$ = Slope Coefficients of X_i

= Error term

3. Results and Discussion

Pattern of income bipolarization by FW and LU: Foster-Wolfson (FW) and Lasso de la Vega and Urrutia (LU) bipolarization indices show similar pattern. Bipolarization decreased between 1980 and 1985, increased up to 1992 and reduces through 1996 to 2004 as shown in Table 1. Bipolarization estimates through FW index were 0.6125, 0.4067, 0.4775, 0.4108 and 0.3529 in the years 1980, 1985, 1992, 1996 and 2004 respectively. This means that the size of the middle class in the rural area increased in 1985, reduced in 1992, then increased in 1996 and further in 2004. This calls for the sustenance of existing macro-economic policies and rural economy development programmes in encouraging the trend to continue. Compare with Awoyemi (2009) bipolarization estimates of 0.49 and 0.37 in 1996 and 2004 respectively, the estimates are close with similar trend. Aigbokhan (2000) also obtained Wolfson bipolarization of 0.72, 0.65 and 0.51 for the rural Nigeria in 1985, 1992 and 1996; these estimates are comparable with our figures. Similar pattern is provided by LU Index. The LU index with = 1.6 and = 1.0 gave the lowest estimates of 0.1676, 0.1430, 0.1610, 0.1460 and 0.1586 in 1980, 1985, 1992, 1996 and 2004 respectively as shown in table 1. So the discussion forthwith will be based on the estimates obtained with degree of alienation parameter = 1.6 and degree of identification parameter = 1.0; the extreme case of bipolarization parameters and the choice of these parameters is at the discretion of the researcher. As shown in Table 1 the estimates of FW are higher than the LU estimates but the two shows similar pattern within the years under consideration. It should be noted that in the period of Structural Adjustment Programme, 1985 through 1992, bipolarization were enhanced while in post SAP era 1996 to 2004 bipolarization reduced. The probing instinct is that why did bipolarization decreased between 1980 and 1985 and then increased from 1985 through 1986 to 1992.

Table 1. Extent and Pattern of Income Bi-polarization

| | | Bi-Polarization Indices | | | |
| | | Lasso de la Vega and Urrutia | | | |
Year	Foster-Wolfson	= 1.6; = 1.0	= 1.6; = 0.5	= 1.0; = 1.0	= 1.0; = 0.5
1980	0.6125	0.1676	0.2024	0.2540	0.3068
1985	0.4067	0.1430	0.1667	0.2168	0.2526
1992	0.4775	0.1610	0.1951	0.2440	0.1899
1996	0.4108	0.1460	0.1703	0.2213	0.2582
2004	0.3529	0.1383	0.1586	0.2096	0.2404

One would recollect that the Federal Government of Nigeria said that economy policy of SAP was a failure in Nigeria instead of improving the income of the rural households, it made it worst. But in subsequent years, the economic frameworks and programme like National Economic Empowerment and Development Strategy, National Poverty Eradication Programme and Fadama Programme appear to be helping in increasing the middle class size in the rural areas. This perhaps is in tandem with the findings of NBS (2007) which showed that there was an upward movement from the core poor to the upper middle class and specifically there was a movement from 12 per cent income of the lowest class to an increase of more than 7 per cent of the upper middle class in 2004. Thus the pattern of bipolarization reflects the policy environment and political economy of the country.

As shown in Table 2, when poverty gap increases, bipolarization increases and when it decreases, bipolarization decreases. In 1980, poverty gap was 0.4481 and bipolarization was 0.2502. In 1985, 1992, 1996 and 2004, the former was 0.2955, 0.3603, 0.2665 and 0.1927 while the later was 0.1939, 0.2110, 0.1816 and 0.1419 respectively. Poverty incidence was 80.44, 66.95, 71.16, 62.76 and 50.39 per cents for the respective years. Thus, as poverty increases/decreases, bipolarization increases/decreases as well. In rural Nigeria therefore, there are those that are poorer among the rural poor population as it has been reported that about 70 per cent of Nigeria population is poor and majority lives in the rural areas (NBS, 2004). Income is bipolarized in rural Nigeria according to the findings and there are poorer people among the rural population indicating income heterogeneity. As households become poorer they move away from the middle income level where majority should be for equality, to the tail end of the income continuum while fewer and fewer households are left in the middle and of course the upper end of the income continuum is usually of very few households as well.

Relationship between bipolarization, household poverty status and socio-economic features:

As shown below table 3, the diagnostic features of the FW bipolarization tobit regression indicate that left and right censoring were zero as all the 42,525 observations in the data set were used in the analysis. The Pseudo R-sqaure was -0.0379; it was pseudo R-square because there are no direct equivalents of R-square (from OLS regression) in non-linear model. The log likelihood ratio chi-square of 5818.92 (df=26) with a p-value of 0.0000 indicates that the model as a whole fits significantly better than a model with no predictors. In the table 3, one would see the coefficients, their standard errors, the t-statistic, associated p-values and the 95% confidence interval of the coefficients as well as the marginal effect of 100% change in the regressor's value on the regressand. Since bipolarization has been observed to move in the same direction with poverty, the expected signs of the coefficients of the regressors, as shown in table 5, follow those of poverty analyzed by Hahm (2010), Mok *et al* (2007), Omonona (2001), Imai et al (2009) and Gaiha et al (2007).

Age, Poverty Status, Female Gender and Christian/Muslim Religion Status, South Location and Credit access have positive effects on income bipolarization. Household size, Father's and Mother's years of education, Married Status, Farming Occupational Group, Membership of social group, Retired age and Wage employment have negative effects on income polarization. All except household size and credit access follow the apriori expectation. Religion, membership of socio-group, retired age and credit access are not significant even at 10 per cent level of significance; Retired age is significant at 14 per cent while others are significant at higher levels.

Using the marginal effect estimates being superior to the Beta coefficients, If age of household head increases by 1 year, bipolarization will increase by 0.00014 and if household size increases by 1 unit, bipolarization will decrease by 0.00037. If father's or mother's years of education increase by one,

bipolarization will reduce by 0.00027 or 0.00013 respectively. Increasing poverty, female and Christian/Muslim status household head by 100 percent, bipolarization will rise by 0.02520, 0.00119 and 0.00008 respectively. If one increase the Married household heads, farming households, membership of socio-group, retired age households heads and wage employment households by 100 percent bipolarization

will decline by 0.00636, 0.00697, 0.00051, 0.00163 and 0.00105 respectively. If households located in South and Credit access are increased by 100 per cent, bipolarization will rise by 0.01150 and 0.00032 respectively.

Table 2. Poverty and Income Bipolarization

Year	Poverty Index ($\alpha = 0$)	Poverty Index ($\alpha = 1$)	LU Bipolarization ($\alpha = 1.6;\ \beta = 1.0$)
1980	0.8044	0.4481	0.2502
1985	0.6695	0.2955	0.1939
1992	0.7116	0.3603	0.2110
1996	0.6276	0.2665	0.1816
2004	0.5039	0.1927	0.1419

Poverty line: 2-3rd of mean per capita consumption expenditure as proxy for income

The implication of this is that age, poverty and female gender tend to feature or induce higher income bipolarization. Christian/Muslim religion status tends to induce higher bipolarization but is not significant. Education, married status, farming, membership of socio-group, retired age and wage employment reduces income bipolarization while South location and Credit access enhances income bipolarization among households, though religion status, socio-group membership, retired age and credit access are not significant. The coefficient of education shows that the higher the education years of household heads, the less is income bipolarization. The more educated households are, the more opportunities the households have of earning more income. This interpretation means that irrespective of the gender and poverty status of household head, bipolarization is positively related to, for instance, age which may not hold and this informed the use of intercept coefficients.

For the differential intercept coefficients relating to the dummy variables in their additive forms the average income FW bipolarization indices of poor households are higher by 0.0252, those of female headed households are higher by 0.00119, those that are Christian/Muslim, South located and credit access are higher by 0.00008, 0.0115 and 0.00032 respectively. Households that are married, farming, member of socio-group, retired age, and wage employment have average income polarization lower by 0.00636, 0.00697, 0.00051, 0.00163 and 0.00105 respectively (refer to table 3) compared with their base categories. Interactively, however, some of the signs and level of significance change for some of the covariates, as shown in same table 3.

According to Table 3, the average income bipolarization index for poor-female headed households is higher by 0.00492 and that of poor-married household is lowered by 0.01652. Similarly, for poor- conventional religion, it is higher by 0.00465 whereas, poor-farming, poor- membership of socio group, poor and 60 years of age minimum, poor- wage employment, poor-south located and poor- access to credit are lower by 0.01048, 0.00105, 0.00252, 0.00060, 0.00569 and 0.00128 respectively when compare with their base categories. Poor households with respect to age have mean income bipolarization that is higher by 0.00041, but with respect to household size and father's education their average income bipolarization is lower by 0.00102 and 0.00058 respectively compared with their base category non-poor.

Table 4 reveals that the sum bipolarization interactive effect of poor-female of 0.03131 is higher relative to poor male or non poor-female and this value is higher than 0.0252 of poverty difference alone and 0.00119 gender difference alone. This probably signals that gender issue will remain one important source of input in income distribution policy as this study shows that income distribution is more polarized among females than male.

Poor - married sum interactive effect of 0.00232 is higher than their base category but the value is lower than the 0.0252 poverty difference alone and higher than marital difference alone (-0.00636). This should not be a surprise finding because most of the household heads are married and their lower mean bipolarization effect only has downward pressure on the sum interactive effect

Table 3: Tobit Regression of Foster-Wolfson Bipolarization

Foster-Wolfson Polarization	Coef	Std. Err	t	P>/t/	Marginal Effect
Age	0.00017	0.00003	6.34	0.000*	0.00014
Household Size	-0.00045	0.00008	-5.51	0.000*	-0.00037
Fathers Education	-0.00034	0.00004	-8.49	0.000*	-0.00027
Mothers Education	-0.00016	0.00003	-5.83	0.000*	-0.00013
Poverty Status – Poor	0.03073	0.00303	10.13	0.000*	0.02520
Gender – Female	0.00146	0.00050	2.93	0.003*	0.00119
Marital Status – Married	-0.00775	0.00076	-10.18	0.000*	-0.00636
Religion Status – Christian/Muslim	0.00010	0.00131	0.07	0.943	0.00008
Occupational Group- Farming	-0.00839	0.00074	-11.28	0.000*	-0.00697
Membership Group- Membership	-0.00062	0.00065	-0.96	0.329	-0.00051
Retired Age Status- Minimum of 60yrs years	-0.00202	0.00110	-1.84	0.066	-0.00163
Employment - Wage employment	-0.00131	0.00057	-2.31	0.021*	-0.00105
Geographical Location- South	0.01403	0.00053	26.74	0.000*	0.01150
Credit Status- Credit access	0.00039	0.00057	0.68	0.494	0.00032
Poor-Female	0.00599	0.00078	7.70	0.000*	0.00492
Poor-Married	-0.02118	0.00120	-17.65	0.000*	-0.01652
Poor- Christian/Muslim	0.00572	0.00213	2.69	0.007*	0.00465
Poor- Farming	-0.01311	0.00124	-10.55	0.000*	-0.01048
Poor- Membership of Socio-Group	-0.00130	0.00099	-1.31	0.191	-0.00105
Poor- Minimum 60 years old	-0.00314	0.00178	-1.77	0.077	-0.00252
Poor- Wage employment	-0.00075	0.00085	-0.84	0.382	-0.00060
Poor-South located	-0.00719	0.00087	-8.30	0.000*	-0.00569
Poor- Access to credit	-0.00158	0.00088	-1.81	0.071	-0.00128
Poor-Age	0.00051	0.00004	11.90	0.000*	0.00041
Poor-Household Size	-0.00126	0.00012	-10.62	0.000*	-0.00102
Poor-Fathers' Education	-0.00072	0.00005	-14.63	0.000*	-0.00058
Constant	0.17493	0.00191	161.17	0.000*	----------
/Sigma	0.0352	0.00012			

Summary: 0   left censored observations   0   right censored obervations   42525   Uncensored observations

Number of obs = 42525   LR CHI2(26) = 5818.92   Prob > chi2 = 0.0000   Log likelihood = 79722.16   Pseudo R2 = -0.0379

t_{tab}:1% =0.005; 5% =0.025:10% =0.05 where * indicates P values less than 5% (significant at 5%)   ** Significant at 10 %

Poor – religion: The sum interactive effect shows that the household heads that are poor with religion affiliation have average income polarization of 0.02993 more than those that are non-poor with religious affiliation. This value is more than the poverty level difference (0.0252) and religion difference (0.00008) if considered separately. Though not significant, religion affiliation tends to contribute more to income bipolarization. This is contrary to the idea that being a member of a religious group could afford a household of additional income through interpersonal gifts in terms of money and material items. Religious organization can also give such items to their members thus belonging to a religious organization should have income equalizing effect. It is also common in Nigeria context that religious groups identifies their members' areas of professions and affords them with income rewarding jobs in the religious system.

Table 4. Interactive Effect of the Coefficients:

Interactive or Multiplicative Dummy	Sum of Differential Intercepts and Slope coefficients & Multiplicative Coefficients	Total Interactive Effect
Poor-Female Household	0.02520 + 0.00119 + 0.00492	0.03131
Poor- Married Household	0.02520 - 0.00636 - 0.01652	0.00232
Poor- Christian/Muslim Household	0.02520 + 0.00008 + 0.00465	0.02993
Poor- Farming Household	0.02520 - 0.00697 - 0.01048	0.00775
Poor- Member of Socio-Group	0.02520 - 0.00051 - 0.00105	0.02364
Poor- 60 years old Minimum	0.02520 - 0.00163 - 0.00252	0.02105
Poor- Wage employment	0.02520 - 0.00105 - 0.00060	0.02355
Poor- South Located	0.02520 + 0.01150 - 0.00569	0.02066
Poor- Access to credit	0.02520 + 0.00032 - 0.00128	0.02424
Poor- Age of Household Head	0.02520 + 0.00014 + 0.00041	0.02575
Poor- Household Size	0.02520 - 0.00037 - 0.00102	0.02381
Poor- Father's Education	0.02520 - 0.00027 - 0.00058	0.02435

Poor and farming household have sum interactive effect of 0.00775 higher when compared with their base category. The value is lower than poverty intercept but higher than farming intercept and their slope coefficients of 0.0252, -0.00697 and -0.01048 respectively. This means that poor and non-farming households have less average income bipolarization indices.

Poor and membership of socio-group with total interactive coefficient of 0.02364, the households that fall into this category have income bipolarization that is higher by 0.02364 than their base category, non poor – membership of socio group or poor non-membership of socio-group. This value is lower than poverty difference alone (0.0252) and higher than membership of socio-group difference (-0.00051) when taken into consideration alone. The household heads that are poor and minimum of 60 years old have sum mean bipolarization indices of 0.02105 lower than the poor households intercept difference or higher than the households that are 60 years old minimum (-0.00163) compared with the poor below 60 years of age or non poor-60 years old minimum and it is between 0.0252 (poverty status alone) and -0.00163 (active age difference alone). This shows that among the rural households there probably exists lower income bipolarization among those that are 60 years old and above than those below. As age increases, productivity increases, ceteris paribus, get to peak and start declining to the point of negative. It is only aged people that have probably remittances, savings and socio-economic insurance, for instance, standing perennial cash crops that may not become poorer, that is, that may not fall into victim of being at the tail end of income distribution continuum.

Bipolarization is therefore lower among the aged.

Poor and wage employment household heads have sum interactive income polarization indices of 0.02355 less than poverty difference, 0.0252 but more than those on wage employment difference, -0.00105 compare with their base category, poor-non wage employment or non-poor wage employment. This perhaps implies that with wage employment, polarization of income tends to decline. In the rural area, there exists little or no wage employment opportunities except probably on-farm hired labour which may be one of the reasons for high income bipolarization.

Poor-South located households have sum interactive income bipolarization indices of 0.02066 lower than poverty difference alone (0.0252) but higher than south-located alone (0.0115) compared with their base category, poor -North located or non-poor south located. This implies that income bipolarization indices are higher in the South than in the Northern Nigeria on the average.

Poor- access to credit: The Household heads that fall into this category have sum interactive average income polarization index of 0.02424 higher than their base category, non-poor credit access household heads. This index is lower than 0.0252 (poverty difference alone) and higher than 0.00032 (access to credit difference alone). All these covariates of poverty indicate that poverty has large significant positive effect on bipolarization.

From table 3, the differential slope coefficient of income polarization of the poor households with respect to age, 0.00041 is significantly higher than the non-poor just like its intercept coefficient of 0.0252 is significant both with p values of less than 1

percent. The slope coefficient of the polarization function with respect to age significantly differs for poor households and non poor households just like their intercept coefficient significantly differs as well. One may reject the hypothesis that polarization indices for the poor and non poor households with respect to their age are the same.

The differential slope coefficient of the bipolarization of the poor households with respect to household size is 0.00102 less than those of the non poor and it is significant just like the intercept coefficient of the poor households is higher by 0.0252 than that of the non poor households and is also significant. Therefore there is significant difference between the polarization of the poor households and non poor households with respect to the number of individuals per house.

The differential slope coefficient of the bipolarization function of the poor households with respect to father's education is 0.00058 less than that of the non-poor households just like the intercept coefficient is higher by 0.0252 than that of the non poor households. The two coefficients are significant at 1 per cent level and indicate that the income polarization function in respect to fathers' education differs between the poor and non poor households. Polarization has significant relationship with the socio-economic characteristics of households.

4. Conclusion

In this paper, we have applied Foster-Wolfson (1994) and Lasso de la Vega bipolarization (2006) indices to estimate bipolarization in the Nigeria rural sector from 1980 to 2004. Bipolarization reduced from 1992 to 2004 indicating that income distribution is improving in the sector. We linked bipolarization with poverty and it was established that they both moved in the same direction. If the income distribution have more poor households, the more it becomes bipolarized; a feature that should be expected in Africa where poverty level is high. The consequence social conflict and tension from bipolarization should be avoided through income redistribution policy that will balloon the middle class in the rural area where income distribution is heterogeneous with majority of Nigeria population. We equally showed that it is possible to apply regression analysis in bipolarization analysis by relating bipolarization with households' socio-economic variables. Income bipolarization was higher among households that are poor, female-headed, lower among married, farming based and members of social group household heads compared with their base categories. Bipolarization was higher among South located households than those in the North. Poverty has the highest positive significant

effect on bipolarization. Focus would therefore have to be more in the South on income equalizing and redistribution policy to reduce bipolarization. We suggest that in the rural area, membership of social group should be promoted, education made accessible, wage employment encourage and efforts at reducing poverty should be stepped up to reduce bipolarization and prevent the revolt that could result from it. However, we are not unmindful of the short-coming of our data sets that were of very little documentation with the exception of 2004 data point. This we played down by verbal discussion and explanation with the staff of the Statistical Department of Nigeria.

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