

## Income Polarization and Bipolarization across Rural Households' Socio-economic Features in Nigeria

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**Abstract:** Income polarization which is the disappearance of the middle class is of two variants, increasing spread called increased polarization and clustering of individuals at polar ends, increasing bipolarization; and it has the consequence of breeding tension and conflict if not checked. In spite of being an important feature of income distribution there is dearth of literature on it especially with African data with many studies focusing on inequality. This paper analysed the two variants of income polarization using Duclos Esteban and Ray polarization index, Foster Wolfson bipolarization index and Tsui and Wang bipolarization index along socio-economic dimensions with real per capita household expenditure for the years 1980, 1985, 1992, 1996 and 2004 setting 1980 as base year for the rural household in Nigeria. The rural sector was chosen as majority of Nigeria's population resides in the rural area and agriculture is rural based having the highest contribution to the country's Gross Domestic Product. Polarization and bipolarization indices followed similar pattern for all between and within socio-economic dimensions. They decreased from 1980 to 1985, then increased to 1992 and reduced through 1996 to 2004. Between the socio-economic dimensional groupings, polarization and bipolarization were high for age difference, education, occupation, wage - no wage and marital status with the highest estimate of 0.1935 for age difference. The least polarization and bipolarization estimates of 0.1772 and 0.3270 were from north-south dimension. Within dimensions however, bipolarization of 0.3245 was higher in the south than in the north with 0.3240 whereas polarization was lower in the south, 0.1759, than in the north, 0.1787 in 2004. Non-wage, single marital status, male and no education dimensions has higher within polarization and bipolarization than their opposite categories. Income redistribution policy should be focused more on education, marital status and age dimensions to prevent possible social tension and conflict that could result from polarized income distributions along these socio economic dimensions.

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**Key words:** Income distribution, polarization, rural households' characteristics, conflict

### 1. Introduction

Over the years income distribution analysis has been one area of research both in developed and developing countries including Nigeria. The studies have all along focused on inequality over the past years and some of them include Alayande (2003), Awoyemi (2004), Awoyemi and Adeoti (2004), Babatunde (2008), Oyekale *et al* (2006), Olaniyan and Awoyemi (2005) and Aigbokhan (2000). However, Aigbokhan (2000) noted that it is not sufficient to establish whether there was an increase or decline in inequality during economic reforms but it is more assisting to determine if such change gave rise to polarization. According to him, if there is polarization, the consequent social tension may have implications for the sustainability of the reform. This position emanated from the catastrophic consequence of income polarization.

Polarization is related to the alienation that individuals and groups feel from one another fuelled by ideas of within-group identity. Accordingly, group

identity and alienation are pivotal to polarization and enhance social tensions: strikes, demonstrations, processions, violence and revolt. Alienation encourages polarization while identification makes polarization to scale up. Polarization anchors on the interplay of these two forces and it is the product of average alienation, average identification, and the mean-normalized covariance between alienation and identification (Duclos, Esteban and Ray, 2004).

If income distribution is polarized between households or between and within male- and female-headed households for instance, such situation could breed social tension, antagonism and conflict as a result of envy, feelings of deprivation and dissatisfaction that could lead to disruption of peace and destruction of social infrastructure and other physical structures like houses. If this conflict starts in the rural area, some people may leave for semi-urban and urban areas thereby aggravating rural-urban drift. Given that about 70 per cent of the Nigeria population lives in the rural areas (NBS, 2006), there

could also be spill-over effect of the conflict in rural areas to the urban areas. Also, Nigeria agriculture is rural based and the sector recorded the highest contribution to the country's Gross Domestic Product in year 2009 (NBS, 2010) which means that if conflict starts in the rural area, the economy will be badly affected. Examining polarization within and between socio-economic characteristic groups would engender the possibility of determining which characteristics contribute more to income polarization through comparisons.

In spite of the importance of income polarization as a feature of income distribution, literature on it is very lean and much is desired (Wang and Tsui, 2000) and even in Nigeria, apart from the pioneering work of Aigbokhan (2000) and the work of Awoyemi *et al* (2009) little is known about income polarization along rural, urban and socio-economic dimensions in Nigeria. Polarization is the disappearance of the middle class (Wolfson, 1997; Aigbokhan, 2000; Chakravarty and Majumder, 2001; Vanderpuye-Orgle, 2002) and there are two variants of it, increase polarity and increasing bipolarity. In a given income distribution, if individuals around the middle level income begin to move away towards the ends, the distribution is said to be showing increasing spread, called polarization whereas increased bipolarization occurs if the individuals in the income distribution above and below the median income level move closer to each other at the polar ends (Chakravarty and Majumder, 2001; Chakravarty, Majumder and Roy, 2007). For increasing spread, both polarization and inequality will increase while the latter, clustering at polar ends will increase polarization and reduce inequality. Therefore polarization is different from inequality, though both are characteristics of income distribution. The former refers to the thinning out of the middle class and the latter measures the distance of each income level from the median income which is the overall dispersion of the distribution. With this clarity, the paucity of knowledge on income distribution analysis that focused on polarization in Nigeria makes this study appropriate.

In measuring polarization, indices that have been developed include Foster and Wolfson (1992), Wolfson (1994, 1997), Esteban, Gradin and Ray (1999), Zhang and Kanbur (1999), Wang and Tsui (2000), Chakravarty and Majumder (2001), Gradin (2000) and, Duclos Esteban and Ray (2004). Esteban, Gradin and Ray (1999) can be applied to data for which the density function has been defined parametrically or non-parametrically and it is an extension of the Esteban and Ray (1994) in measuring income polarization. The assumption and division of the elements or individuals in the income

distribution into a finite number of groups weakens Esteban and Ray index (Awoyemi *et al*, 2006; Schmidt, 2009) because income is a continuous variable. Wolfson (1994) and Esteban and Ray (1994) disagree with the basic Pigou-Dalton axiom of income transfer in their polarization analysis. We apply Duclos, Esteban and Ray index (DER), Tsui and Wang (TW) index and Foster-Wolfson index (FW) in this paper.

The use of DER, FW and TW makes the result to be robust and follows past studies (Zhang and Kanbur, 1999; Gradin, 2000; Awoyemi *et al*, 2009) in which multiple indices were used. DER also has the advantage of dealing with the problem associated with Esteban and Ray (1994) because is not restricted to pre-grouping of data. FW is a movement away from inequality measurement, though it captured Lorenz curve and Gini-coefficient. DAD 4.5 Software is equally available to apply these indices along specified socio-economic dimensions of the rural households. Policy-wise, as the pattern of income distribution remains one source of input to policy formulation and implementation, this study by exposing the extent of income polarization among the rural households in terms of gender and other socio-economic variables like many rural economic problem studies which include Babatunde (2008), Oyekale *et al* (2006) and, Nnadi and Nnadi (2009) will provide the basis for developing appropriate policy in preventing shrinking or disappearing 'Middle Class' in Nigeria. With appropriate policy, there will be more equitable distribution of income and possible social conflict and tension could be checked. Valuable information is thus provided for more precise rural targeting of income redistribution policy in Nigeria.

## 2. Methodology

The geographical area was the rural Nigeria. The sample frame is all the rural households enumerated by National Bureau of Statistics 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, 1985, 1992 and 1996 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 extracted from diskettes obtained from NBS. It should be noted that the surveys were done with assistance of the World Bank and British Council (NBS, 2004). Aigbokhan (2000) reported that the 1996 survey was similar in design and execution as the 1992/93 survey, the sample of which was also like 1985 survey sample involving a two stage

stratified sampling technique. Total of 4685, 4044, 5712, 11358 and 42, 525 observations for the five data points of 1980, 1985, 1992, 1996 and 2004 were used respectively. Real per capita consumption expenditure of the households as proxy of income was used by setting 1980 as based year. Polarization and bipolarization between and within socio-economic dimensional groupings were then analyzed using the following indices:

Polarization Index: Duclos, Esteban and Ray (2004) Index (DER)

Polarization is declared to be proportional to the sum of all effective antagonism, that is, identification and alienation.

$$P(F) = \iint T[f(x), |x - y|] f(x) f(y) dx dy \dots (1)$$

This measure of polarization satisfies a set of axioms: if it is proportional to

$$P_\alpha(F) = \int f(y)^\alpha g(y) dF(y) \dots (2)$$

These axioms are:

- i. If a distribution is made up of a basic density, then a squeeze cannot increase polarization
- ii. If a symmetric distribution is composed of three basic densities then a squeeze in the outer densities should not reduce polarization. Here the squeeze in local and not global.
- iii. If a symmetric distribution made up of four basic densities with disjoint supports, then a move of the centre distributions towards their outer neighbours, while keeping the disjoint supports, should increase polarization. This means that a symmetric outward slide will increase polarization.
- iv. Given two distributions F and G, if P(F) > P(G), P(G), being P(F) and P(G) the respective polarization indexes, it must be that P( F / P( G) where F and G represent a rescaled version of F and G

Polarization is proportional to the sum of all effective antagonisms written as

$$P(F) = \iint T[f(x), |x - y|] f(x) f(y) dx dy \dots (3)$$

This satisfy the four polarization axioms state above, if and only if it is proportional to

$$P_\alpha(f) = \iint f(x)^{1+\alpha} f(y) |y - x| dy dx, \dots (4)$$

where  $\alpha \in [0.25, 1.0]$ , we used 1.0, the extreme levels of identification and alienation forces for the analysis. However, since the study is interested on socio-economic dimensions of polarization, following Duclos *et al* (2004), polarization measure is rewritten as

$$P^*(F) = \sum_{j=1}^G \sum_{k \neq j} \iint f_j(x)^\alpha |x - y| dF_j(x) dF_k(y) \dots (5)$$

where, G = number of groups

F = income distribution in the population

$\alpha$  = degree of alienation between groups x

and y

g(y) = alienation effect

f(y) = identification effect

F = density

P(F) = polarization of F

G = 1 = undimensional polarization

x = income group or level of income x

y = income group or level of income y

$x_i$  = individual i, located at x

$y_j$  = individual j located at y

$|x - y|$  = monotonic distance between x and y

DAD 4.5 software (Duclos et al, 2008) was used for the analysis of this equation and the index that follows.

Bipolarization Index

Foster-Wolfson (1992) index through Awoyemi et al (2006) was used and it is based on the Lorenz curve, derived from the Gini Coefficient and defined as

$$P^{FW} = \frac{2(2T - Gini)}{\left(\frac{m}{\mu}\right)} \dots (6)$$

where,

$P^{FW}$  = Foster-Wolfson Polarization Index

T = 0.5 - L(0.5)

L(0.5) = the value of the Lorenz curve at the 50<sup>th</sup> percentile, meaning the share of the

bottom half of regions of the index

m = median income (Naira)

$\mu$  = mean income (Naira)

However, the analysis is based on the equation demonstrated by Duclos, et al (2008) for the group k which is similar to equation (6) and is expressed as

$$FW(k) = \frac{2[2[0.5 - L(k, 0.5)] - I_2(k)]}{\mu(k)} \dots (7)$$

$$= \frac{\xi(k; p=2) - 2GL(k, p=0.5)}{Q(k, p=0.5)} \dots (8)$$

Where:

$\xi$  = The Gini social welfare Index

GL(p) = The Generalized Lorenz Curve

Q(p) = The Quantile function

$I_2(k)$  = The Gini index of inequality

Tsui and Wang (TW) Index: According to Zhang and Kanbur (1999), Tsui and Wang (1998) generalize a new class of indices based on the Wolfson index using the two partial ordering axioms of increased bipolarity and increased spread. TW polarization model is expressed as

$$TW = \frac{\theta}{N} \sum_{i=1}^K \Pi_i \left| \frac{y_i - m}{m} \right|^r \quad \dots\dots (9)$$

where,

$N$  = the number of total population

$\Pi_i$  = the number of population in group  $i$  or the population share of group  $i$

$k$  = the number of groups

$y_i$  = the mean value of in group  $i$

$m$  = the median income

$\theta$  = a positive constant scalar (0.5 or 1.0; 0.5 was used as 1.0 doubled the estimate)

$r \in (0,1)$ , for this research  $r = 0.5$

Awoyemi et al (2006) mentioned that this model link partial ordering with the well known Lorenz partial ordering in inequality measurement. 'Partial' is opposite of 'complete' and partial ordering means that not all distributions of interest can be ranked-ordered. The TW index is being used to add to the robustness of the results in terms of magnitude and direction of estimates across the period under consideration.

### 3. Results and Discussion

Pattern of income polarization and bipolarization between household's socio-economic dimensions:

DER Polarization Index ( $\theta = 1.0$ ): As shown in table 1, along the socio-economic dimensions, polarization reduces from 1980 to 1985 then increased to 1992 and by 1996 reduced and further declined in 2004. In 2004, North-South dimension gave the least polarization index of 0.1772 while highest polarization expenditure distribution is between retired and non retired age, 0.1935. Between marital status dimensions, the highest income polarization was recorded throughout the periods of consideration at least on the average with the highest index of 0.5246 in 1985. Between educated and non-educated households, polarization is also high and it was 0.1883 in 2004. Equally shown in the table are the estimates of alienation and identification for the dimensions while the figure in brackets is the standard error of polarization estimates. The general

pattern is that where alienation and identification are relatively higher, polarization is relatively higher which confirms that the two forces interact for effective antagonism, polarization. If there is going to be social tension and demonstrations resulting from income polarization, these results show that it may come from education, wage, marital and age dimensions.

In table 1, the empty space between 1980 and 1996 for religion group, access-no access to credit and membership of socio-group is because the data for the stated years did not feature these characteristics. So comparing with other dimensions in 2004, the polarization indices they generate falls within the range of marital status, wage employment, farming-non farming and education dimensions. These dimensions are the between group polarization.

FW Bipolarization index:

The pattern of bipolarization along socio economic dimension reveals a decreasing trend from 1980 to 2004 for the entire dimension considered except for marital status as shown in table 2. The figures in parenthesis are the standard errors of bipolarization estimates. Foster-Wolfson Bipolarization obtained varies from the least estimate of 0.3190 in 1992 and the highest estimate of 0.5816 in 1985 along marital status. For North-South, F-W bipolarization was 0.4814, 0.3702, 0.4537, 0.3651 and 0.3270 for 1980, 1985, 1992, 1996 and 2004 respectively. For gender, estimates were 0.4571, 0.3790, 0.5044, 0.4001 and 0.3460. The estimates for religious dimension, access to credit and membership of socio group could only be obtained for 2004 as other years' data points did not feature these characteristics.

In 1980, marital status contributed the highest bipolarization index of 0.5172 followed by geographical location along North-South 0.4814, then farming-non farming (occupation of household heads) 0.4627. Next is gender of 0.4571 then primary education and Formal or Informal education of 0.4531 and 0.4441 respectively. Wage-No wage employment and age provided the least estimates of 0.4306 and 0.3734 respectively. This shows that in 1980, marital status, geographical location, gender and type of occupation contribute more to income bipolarization. Perhaps middle class tends to shrink more along marital status followed by North-South, occupation and gender dimensions. Education level and type of education are at the tail end of explaining bipolarization in 1980. In 1985, Marital status gave the highest level of bipolarization of 0.5816, followed by gender 0.3790 then North-South, Farming-Non farming, Retired age difference, Primary education difference, Education-No education and the least of

0.3357 was given by Wage-No wage. This indicates that in terms of wage, there is little income disparity. With low bipolarity more people cluster around the middle income level. However, with marital status, more people move away from the middle class to the polar ends of the distribution and majority would have moved to the lower tail of the income distribution. Similarly, along gender, bipolarization is high. In the rural areas most of the households are homogenous in terms of education and wage employment, explaining the relatively low polarization but are now becoming heterogeneous in terms of occupation which could be the reason for the relatively high income polarization in this dimension.

In 1992, Gender explains the highest income bipolarization of 0.5044, followed by geographical location then occupation (Farming or Non farming), wage employment while marital status is the least element explaining income bipolarization with an estimate of 0.3190 followed by age and education dimensions. In 1996, marital status explains the highest bipolarization estimates of 0.4519, followed by farming occupation of 0.4061, Gender with 0.4001, primary/non primary education of 0.3807. Wage-No wage of 0.3583, North-South estimate of 0.3651, Education-No education 0.3728 and retired age, 0.3762 were the least. In 2004, retired age difference is the element with the highest income bipolarization followed by farming-Non farming (type of employment), education follows with 0.3559, then marital status of 0.3550, membership of socio group 0.3509 and access to credit of 0.3465. Wage employment gave 0.3463; gender influenced 0.3460 income bipolarization estimates. In all these, marital status, gender, wage, geographical location between

North-South, Farming and Non farming are the most elements informing high income bipolarization

#### **Tsui and Wang Bipolarization index between household's socio-economic dimensions:**

Furthermore, as shown in Table 3, gender, marital status and wage-no wage employment give the highest bipolarization estimates of 0.4611 in 1980 followed by primary education 0.4608, then formal/informal education-No formal/informal education 0.4602 then farming-non Farming of 0.4554. The least estimate is from North-South dimension. In 1985, marital status determines the highest bipolarization estimates of 0.3558, followed by Gender, Retired age, Formal/Informal education, Primary education, Wage-No wage, farming-Non farming and North-South of the estimates 0.3547, 0.3542, 0.3514, 0.3511, 0.3494, 0.3485 and 0.3431 respectively. In 1992, gender explains the highest polarization estimates of 0.4239 followed by that of marital status, Wage employment, North-South location, Retired age, farming-Non farming, Primary education and education of 0.4238, 0.4237, 0.4233, 0.4219, 0.4204, 0.4183 and 0.4169 respectively. This implies that to obtain better income distribution, Education, Age and Occupation somehow have contribution with the policy framework of that year and that gender difference will remain a factor in income distribution as male headed households or female headed households heads could be badly affected instead of balancing it due to gender difference. Some researchers have pointed out that women are rendered poorer than men during adjustment policies (World Bank, 1996) while some suggested the reverse (Canagarajah et al, 1997).

Table 1. Income Polarization between Socio-Economic Eimensions

		Duclos, Esteban and Ray Polarization (DER: = 1.0)				
Dimension		1980	1985	1992	1996	2004
North-South	Alienation	0.5137	0.4333	0.4993	0.4302	0.3716
	Identification	0.6470	0.5973	0.5933	0.6336	0.6005
	DER: = 1.0	0.2338	0.1919	0.2158	0.2022	0.1772
	(Standard Error)	0.0080	0.006	0.0051	0.0038	0.0014
Male-Female	Alienation	0.4874	0.4460	0.5192	0.4465	0.3924
	Identification	0.5699	0.5276	0.5901	0.5988	0.5948
	DER: = 1.0	0.2063	0.182	0.2273	0.2000	0.1830
	(Standard Error)	0.0108	0.0055	0.01	0.0063	0.0013
Single – Married	Alienation	0.4973	0.3798	0.483	0.5302	0.3957
	Identification	1.0742	1.6282	0.7539	0.5631	0.5917
	DER: = 1.0	0.4073	0.5246	0.2528	0.2203	0.1844

	(Standard Error)	0.1279	0.1591	0.0480	0.0171	0.0016
Wage-No Wage	Alienation	0.5055	0.4047	0.502	0.4218	0.3932
	Identification	0.6532	0.5857	0.6091	0.6175	0.5966
	DER: = 1.0	0.2301	0.1802	0.2204	0.1952	0.1836
	(Standard Error)	0.0055	0.0031	0.0042	0.0023	0.0011
Farming-Non Farming	Alienation	0.4967	0.441	0.5051	0.4645	0.4024
	Identification	0.6277	0.5701	0.6126	0.611	0.5891
	DER: = 1.0	0.2239	0.1880	0.2231	0.2116	0.1880
	(Standard Error)	0.0076	0.0069	0.0073	0.0056	0.0028
Retired Age – Below 60 years	Alienation	0.4409	0.4148	0.4849	0.4249	0.4246
	Identification	0.6471	0.5701	0.6279	0.5992	0.5906
	DER: = 1.0	0.2119	0.1820	0.2209	0.1955	0.1935
	(Standard Error)	0.0089	0.0078	0.0088	0.0052	0.0036
Formal/Informal-No Education	Alienation	0.5012	0.4273	0.5052	0.4403	0.3973
	Identification	0.6742	0.5992	0.6321	0.6417	0.6063
	DER: = 1.0	0.2376	0.1898	0.228	0.2081	0.1883
	(Standard Error)	0.0064	0.0072	0.0072	0.0048	0.0016
Less and Minimum Primary Education	Alienation	0.4985	0.4242	0.5217	0.4671	0.3881
	Identification	0.7643	0.6109	0.6411	0.6487	0.6128
	DER: = 1.0	0.2880	0.1917	0.2344	0.2186	0.1872
	(Standard Error)	0.0081	0.0078	0.0134	0.0098	0.0019
Religion – No Religion	Alienation					0.3789
	Identification					0.6353
	DER: = 1.0					0.1886
	(Standard Error)					0.0058
Access To Credit –No Access	Alienation					0.3917
	Identification					0.6007
	DER: = 1.0					0.1842
	(Standard Error)					0.0020
Membership- Non Memb of Social Group	Alienation					0.3899
	Identification					0.5896
	DER: = 1.0					0.1823
	(Standard Error)					0.0022

More so, in 1996 as shown in table 3, age is found to give the highest estimate of income bipolarization of 0.3630 followed by gender difference of 0.3622 and wage-no wage, farming-non farming, primary education, North-South Location, Education- No Formal/Informal education and marital status of estimates 0.3615, 0.3591, 0.3574,

0.3522, 0.3519 and 0.3493 respectively. From these estimates, to have the size of the middle class improved; socioeconomic issues of marital status, age, formal/informal education, primary education and geographical location are somehow key elements that need to be considered for income bipolarization reduction policies.

For 2004 as shown in table 3, membership of socio group gave 0.2992 bipolarization estimate, followed by access to credit, 0.2835 and religion group of 0.2835. Along North-South dimension bipolarization was 0.2438, Gender, 0.2834 and education 0.2834 while wage employment influenced bipolarization of 0.2832 followed by Farming-non farming of 0.2808 and retired age of 0.2801. By 2004, the political economy was stable and the policy environment contained programme targeted at improving rural income like FADAMA I and II. This may be one reason for membership of socio-group and access to credit to give high estimates of polarization. Through FADAMA I and II progress is being made with farmers that have constituted into groups and they have access to credit thus improving their asset base, productivity and income. This could cause gap in income distribution against some set of households to move to the lower tail.

#### **Polarization and Bipolarization within sub-populations of the rural households:**

As shown in table 4 for 2004, polarization and bipolarization are higher among non-farming households than farming households. Bipolarization

is higher in the South (0.3245) than in the North (0.3240) while polarization is lower (0.1759) in the South against 0.1787 in the North. The female headed households have higher polarization and bipolarization than the male. Those on non-wage employment have higher bipolarization (0.3463) and polarization (0.1833) than those on wage employment of 0.3422 and 0.1799 respectively. The single headed households have higher bipolarization (0.3550) and polarization (0.1826) than the married of 0.3403 and 0.1819 respectively. Those without education have higher bipolarization and polarization of 0.3560 and 0.1867 than the educated household of 0.3372 and 0.1805 respectively. Polarization as the sum of effective alienation and identification forces is clearly shown in the table 4 as well while the figure in parenthesis is the standard error of polarization and bipolarization estimates. Where polarization is higher, effective combined forces of alienation and identification (polarization) estimates are higher. For instance between north and south, alienation and identification are lower in the south than the north which accounted for polarization to be lower in the south than in the north.

Table 2. FW Bi-polarization between Household's Socio-Economic Dimensions

Dimension	Foster- Wolfson Bi-Polarization				
	1980	1985	1992	1996	2004
North-South	0.4814	0.3702	0.4537	0.3651	0.3270
<i>(Standard Error)</i>	<i>0.0157</i>	<i>0.0125</i>	<i>0.0127</i>	<i>0.0076</i>	<i>0.0032</i>
Gender (Male & Female)	0.4571	0.3790	0.5044	0.4001	0.3460
	<i>0.0320</i>	<i>0.0287</i>	<i>0.0288</i>	<i>0.0141</i>	<i>0.0031</i>
Marital Status (Single- Married)	0.5172	0.5816	0.3190	0.4519	0.3550
	<i>0.3034</i>	<i>0.3492</i>	<i>0.0480</i>	<i>0.0330</i>	<i>0.0040</i>
Wage-No Wage	0.4306	0.3357	0.4393	0.3583	0.3463
	<i>0.0098</i>	<i>0.0085</i>	<i>0.0088</i>	<i>0.0045</i>	<i>0.0025</i>
Farming-Non Farming	0.4627	0.3670	0.4479	0.4061	0.3699
	<i>0.0200</i>	<i>0.0180</i>	<i>0.0168</i>	<i>0.0129</i>	<i>0.0069</i>
Retired Age Difference	0.3734	0.3618	0.4274	0.3762	0.3730
	<i>0.0229</i>	<i>0.0215</i>	<i>0.0195</i>	<i>0.0127</i>	<i>0.0077</i>
Formal-No Formal Education	0.4441	0.347	0.4453	0.3728	0.3559
	<i>0.0164</i>	<i>0.0158</i>	<i>0.0153</i>	<i>0.0083</i>	<i>0.0037</i>
Less Primary Education and Min Pri. Educ.	0.4531	0.3458	0.4272	0.3807	0.3451
	<i>0.0267</i>	<i>0.0157</i>	<i>0.0267</i>	<i>0.0142</i>	<i>0.0043</i>
Religion Group					0.3332
					<i>0.0118</i>
Access To Credit					0.3465
					<i>0.0046</i>
Membership of Social Group					0.3509
					<i>0.0055</i>

Figures in Italics are the Standard Errors of the estimates

Table 3. Tsu and Wang Bipolarization between Household's Socio-Economic Dimensions

Dimension	1980	1985	1992	1996	2004
North-South	0.4103	0.3431	0.4233	0.3522	0.2438
Gender (Male – Female)	0.4611	0.3547	0.4239	0.3622	0.2834
Marital Status (Single – Married)	0.4611	0.3558	0.4238	0.3493	0.2829
Wage-No Wage	0.4611	0.3494	0.4237	0.3615	0.2832
Farming-Non Farming	0.4554	0.3485	0.4204	0.3591	0.2808
Retired Age Difference	0.4452	0.3542	0.4219	0.3630	0.2801
Formal/Inform-No Education	0.4602	0.3514	0.4169	0.3519	0.2834
Less Pri. Educ- Pri Educ Minim.	0.4608	0.3511	0.4183	0.3574	0.2801
Religion – No Relegion					0.2835
Access To Credit- No Access					0.2835
Membership - Non Memb. Social Group					0.2992

Table 4. Polarization and Bipolarization within Sub-Population

HouseHold Head Sub-Population	Foster-Wolfson Polarization					Duclos, Esteban & Ray Polarization				
						= 1.0				
	1980	1985	1992	1996	2004	1980	1985	1992	1996	2004
<b>Farming</b>	0.4029	0.3292	0.4454	0.3489	0.3399	0.2169	0.1792	0.2163	0.1921	0.1817
<i>(Standard Error)</i>	<i>0.0100</i>	<i>0.0089</i>	<i>0.0099</i>	<i>0.0048</i>	<i>0.0023</i>	<i>0.0068</i>	<i>0.0034</i>	<i>0.0047</i>	<i>0.0025</i>	<i>0.0010</i>
<i>Alienation</i>						<i>0.4917</i>	<i>0.3997</i>	<i>0.4998</i>	<i>0.4143</i>	<i>0.3866</i>
<i>Identification</i>						<i>0.6327</i>	<i>0.5893</i>	<i>0.5982</i>	<i>0.6159</i>	<i>0.5988</i>
<b>Non- Farming</b>	0.4627	0.367	0.4479	0.4061	0.3699	0.2115	0.1812	0.2081	0.2012	0.1806
<i>(Standard Error)</i>	<i>0.0200</i>	<i>0.018</i>	<i>0.0168</i>	<i>0.0127</i>	<i>0.0068</i>	<i>0.0060</i>	<i>0.0062</i>	<i>0.0063</i>	<i>0.0050</i>	<i>0.0025</i>
<i>Alienation</i>						<i>0.4067</i>	<i>0.4410</i>	<i>0.5051</i>	<i>0.4645</i>	<i>0.4024</i>
<i>Identification</i>						<i>0.5908</i>	<i>0.5483</i>	<i>0.5719</i>	<i>0.5891</i>	<i>0.5691</i>
<b>North</b>	0.3635	0.3301	0.4294	0.3495	0.324	0.2025	0.175	0.2171	0.1910	0.1787
<i>(Standard Error)</i>	<i>0.0105</i>	<i>0.01</i>	<i>0.0115</i>	<i>0.0055</i>	<i>0.0026</i>	<i>0.0061</i>	<i>0.0034</i>	<i>0.0056</i>	<i>0.0029</i>	<i>0.0012</i>
<i>Alienation</i>						<i>0.4464</i>	<i>0.3937</i>	<i>0.5031</i>	<i>0.4155</i>	<i>0.3732</i>
<i>Identification</i>						<i>0.6283</i>	<i>0.5774</i>	<i>0.6019</i>	<i>0.6096</i>	<i>0.6082</i>
<b>South</b>	0.4814	0.4511	0.4537	0.3651	0.3245	0.2180	0.1876	0.2101	0.1985	0.1759
<i>(Standard Error)</i>	<i>0.0157</i>	<i>0.0145</i>	<i>0.0127</i>	<i>0.0076</i>	<i>0.0032</i>	<i>0.0072</i>	<i>0.0055</i>	<i>0.0048</i>	<i>0.0036</i>	<i>0.0013</i>
<i>Alienation</i>						<i>0.5137</i>	<i>0.4333</i>	<i>0.4993</i>	<i>0.4302</i>	<i>0.3716</i>
<i>Identification</i>						<i>0.6015</i>	<i>0.5828</i>	<i>0.5774</i>	<i>0.6220</i>	<i>0.5969</i>
<b>Male</b>	0.425	0.3379	0.4378	0.3568	0.3449	0.2411	0.1842	0.2191	0.1958	0.1823
<i>(Standard Error)</i>	<i>0.01</i>	<i>0.0082</i>	<i>0.009</i>	<i>0.0047</i>	<i>0.0031</i>	<i>0.0086</i>	<i>0.0036</i>	<i>0.0043</i>	<i>0.0025</i>	<i>0.0012</i>
<i>Alienation</i>						<i>0.5467</i>	<i>0.4080</i>	<i>0.5004</i>	<i>0.4224</i>	<i>0.3902</i>
<i>Identification</i>						<i>0.6085</i>	<i>0.5989</i>	<i>0.6078</i>	<i>0.6196</i>	<i>0.5963</i>
<b>Female</b>	0.4571	0.379	0.5044	0.4001	0.346	0.1792	0.1702	0.1979	0.1890	0.1824
<i>(Standard Error)</i>	<i>0.0317</i>	<i>0.0292</i>	<i>0.0284</i>	<i>0.0141</i>	<i>0.0031</i>	<i>0.0071</i>	<i>0.0046</i>	<i>0.0067</i>	<i>0.0056</i>	<i>0.0013</i>
<i>Alienation</i>						<i>0.4874</i>	<i>0.446</i>	<i>0.5192</i>	<i>0.4465</i>	<i>0.3924</i>

<i>Identification</i>						0.4921	0.4952	0.5153	0.5647	0.5932
<b>Wage</b>	0.4037	0.365	0.5233	0.4674	0.3422	0.1659	0.1797	0.1742	0.1733	0.1799
<i>(Standard Error)</i>	<i>0.0385</i>	<i>0.0223</i>	<i>0.0399</i>	<i>0.0353</i>	<i>0.0045</i>	<i>0.0081</i>	<i>0.0085</i>	<i>0.0077</i>	<i>0.0092</i>	<i>0.0016</i>
<i>Alienation</i>						0.4380	0.4457	0.5027	0.5003	0.3846
<i>Identification</i>						0.4981	0.5435	0.4564	0.4716	0.5938
<b>No-wage</b>	0.4306	0.3357	0.4393	0.3583	0.3463	0.2294	0.1798	0.2199	0.1951	0.1833
<i>(Standard Error)</i>	<i>0.0098</i>	<i>0.0085</i>	<i>0.0088</i>	<i>0.0045</i>	<i>0.0025</i>	<i>0.0055</i>	<i>0.0031</i>	<i>0.0042</i>	<i>0.0023</i>	<i>0.0011</i>
<i>Alienation</i>						0.5055	0.4047	0.5020	0.4218	0.3932
<i>Identification</i>						0.6512	0.5842	0.6079	0.6173	0.5958
<b>Single</b>	0.5172	0.5816	0.319	0.4519	0.355	A*	B*	0.1263	0.1749	0.1826
<i>(Standard Error)</i>	<i>0.3474</i>	<i>0.1661</i>	<i>0.0495</i>	<i>0.0343</i>	<i>0.0040</i>	*	*	0.0217	0.0123	0.0016
<i>Alienation</i>						*	*	0.4830	0.5302	0.3957
<i>Identification</i>						*	*	0.3636	0.4479	0.5867
<b>Married</b>	0.4265	0.3449	0.4459	0.355	0.3403	0.2388	0.1834	0.2198	0.1931	0.1819
<i>(Standard Error)</i>	<i>0.0096</i>	<i>0.0079</i>	<i>0.0087</i>	<i>0.0045</i>	<i>0.0026</i>	<i>0.0078</i>	<i>0.0032</i>	<i>0.004</i>	<i>0.0023</i>	<i>0.0011</i>
<i>Alienation</i>						0.5394	0.414	0.5024	0.4171	0.3880
<i>Identification</i>						0.6066	0.5876	0.6054	0.6152	0.5987
<b>Education</b>	0.4177	0.3383	0.4468	0.3463	0.3372	0.2135	0.1798	0.2140	0.1882	0.1805
<i>(Standard Error)</i>	<i>0.0118</i>	<i>0.0092</i>	<i>0.0102</i>	<i>0.0053</i>	<i>0.0028</i>	<i>0.0072</i>	<i>0.0033</i>	<i>0.0048</i>	<i>0.0024</i>	<i>0.0011</i>
<i>Alienation</i>						0.5019	0.4057	0.499	0.4098	0.3873
<i>Identification</i>						0.6080	0.5826	0.5895	0.6049	0.5929
<b>No-education</b>	0.4441	0.347	0.4452	0.3728	0.356	0.2254	0.1822	0.212	0.2025	0.1867
<i>(Standard Error)</i>	<i>0.0164</i>	<i>0.0156</i>	<i>0.0153</i>	<i>0.0083</i>	<i>0.0037</i>	<i>0.0055</i>	<i>0.0063</i>	<i>0.0062</i>	<i>0.0045</i>	<i>0.0016</i>
<i>Alienation</i>						0.5012	0.4273	0.5052	0.4403	0.3973
<i>Identification</i>						0.6390	0.5732	0.5875	0.6243	0.6020

A\* 12 obs out of 5685 obs = .21%

B\* 15 obs out of 4044 obs = 37%

Standard Error in Italics

#### 4. Conclusion

Income polarization which is the thinning out of the middle class is of two variants, increasing spread called increased polarization and clustering of individuals at polar ends, increasing bipolarization; and it has the consequence of breeding tension and conflict if not prevented. We used DER polarization, FW bipolarization and TW bipolarization indices with 1980, 1985, 1992, 1996 and 2004 rural household real per capita consumption data in Nigeria along specified socio-economic dimensions of households. Between the dimension, DER Polarization was highest for active-retired age, 0.1935 and least for North-South, 0.1772. Also Bipolarization was least between north and south with FW and TW estimates of 0.3270 and 0.2438 respectively. Highest FW and TW estimates of 0.3730 and 0.2992 were obtained from north-south

and membership-non membership of social groups respectively. This is capable of informing further debate on the superiority or otherwise of different polarization indices (Zhang and Kanbur, 1999). Within the dimensions, bipolarization of 0.3245 was higher in the south than in the north with 0.3240 whereas polarization was lower in the south, 0.1759, than in the north, 0.1787 in 2004. Non-wage, single marital status, male and no-education dimensions have higher within polarization and bipolarization than their opposite categories, wage, married, female and educated households' heads. More attention should be given to male, non educated, single marital status and wage employed households heads in the design and implementation of income redistribution policies. Through this piece, we have added to the lean literature on income polarization in Nigeria. However, further studies could be done in

establishing the level of significance of polarization estimates along socio-economic dimensions of households for statistically informed decision.

## References

1. Aigbokhan, B.E. Poverty, growth and in-equality in Nigeria: A case study. Development Policy Centre, Ibadan, Nigeria. African Economic Research Consortium, Nairobi, AERC Research 2000: paper 102.
2. Alayande, B. Decomposition of inequality reconsidered. Some evidence from Nigeria. Paper presented at the UNU/NIDER Conference on inequality, poverty and human wellbeing in Helsinki, Finland. 29<sup>th</sup>- 31<sup>st</sup>, May, 2003.
3. Awoyemi, T. T. Explaining income inequality in Nigeria: A regression-based approach. Dept of Agricultural Economics, U.I. Nigeria. Retrieved July 14, 2008 from [http://www.aercafrica.org/aes/papers/group\\_A/A9-Timothy%20Awoyemi.pdf](http://www.aercafrica.org/aes/papers/group_A/A9-Timothy%20Awoyemi.pdf). 2004.
4. Awoyemi, T.T., A.I. Adeoti. The decomposition of income inequality by sources of income: The rural Nigeria experience. African journal of economic policy. 2004; 11(1): 1-16.
5. Awoyemi, T.T., Busayo, O.I., O. Adewusi. Inequality, polarization and poverty in Nigeria. Research proposal presented to PEP Network at 6<sup>th</sup> PEP Research Network general meeting. Retrieved December 5<sup>th</sup>, 2007 from <http://www.pep-net.org/NEW-PEP/HTML/Meetings/Lima/Fichiers%20pdf/pma10832-Awoyemi.pdf>; 2006.
6. Awoyemi, T.T., Busayo, O.I., O. Adewusi. Inequality, polarization and poverty in Nigeria. Working Paper presented to PEP Network. Retrieved December 5<sup>th</sup>, 2009 from <http://www.pep-net.org/NEW-PEP/HTML/Meetings/Lima/Fichiers%20pdf/pma10832-Awoyemi.pdf>. 2009.
7. Babatunde, R.O. Income inequality in rural Nigeria: Evidence from farming households survey data. Australian journal of basic and applied sciences 2(1): 134- 14. ISSN 1991-8178.INSINET publication. Retrieved June 2, 2008 from [www.insinet.net/ajbas/2008/134-140.pdf](http://www.insinet.net/ajbas/2008/134-140.pdf); 2008
8. Canagarajah, S., Ngwafon, J., S. Thomas. The evolution of poverty and Welfare in Nigeria, 1985-92. World Bank Policy Research Working paper No. 1715. Jan. Retrieved January 10, 2008 from <http://www-wds.worldbank.org/external/>; 1997
9. Chakravarty, S.R., Majumder, A., S. Roy. A treatment of absolute indices of polarization. Indian Statistical Institute. The Japanese Economic Review June 2007; 58(2) 273- 292.
10. Chakravarty, S.R., Majumder, A. Inequality, polarization and welfare: theory and applications. Blackwell publishers Ltd, 108 Cowley Road, Oxford OX4 1JF Australian Economic papers 2001; 40:1-13
11. Duclos, J. Arrar, A., C. Fortin. DAD 4.5. A software for Distributive Analysis/MIMAP Programme, International Development Research Centre, Government of Canada and CREFA, University of Laval, Laval; 2008.
12. Duclos, J., Esteban, J., D. Ray Polarization: concepts, measurement, estimation. Econometrica 72(6) November 2004. 1737-1772. Retrieved July 28, 2008 from <http://cc.msnscache.com/cache.aspx>; 2004.
13. Esteban, J., Ray, D. (1994). On the measurement of polarization. Econometrica 62(4):819-851. July. Retrieved August 14, 2008 from <http://www.jstor.org/stable/2951734>.
14. Esteban, J., Gradin, C., D. Ray Extensions of a measure of polarization with an application to the income distribution of five OECD counties. Working paper No. 218. Retrieved July 28, 2008 from <http://www.lisproject.org/publications/liswps/218.pdf>; 1999
15. Gradin, C. Polarization by sub-populations in Spain 1973-91. Review of Income and Wealth 2000; Series 46, No 4.
16. National Bureau of Statistics. News. Information on Nigeria's GDP in 2009. Retrieved August 27, 2010 from [www.nigerianstat.gov.ng/home](http://www.nigerianstat.gov.ng/home); 2010
17. National Bureau of Statistics. The Nigerian statistical facts sheets on economic and socio development NBS. Nov.; 2006.
18. Nnadi, F.N., C.D. Nnadi. Farmers' sustained adoption decision behavior of maize/cassava intercrop technology in Imo State: Lessons for extension policy development. World Rural Observations 2009; 1(1):1-6
19. Olaniyan, O., Awoyemi, T.T. Inequality in the distribution of household expenditure in rural Nigeria: A decomposition analysis. Draft final research report, African Economic Research Consortium (AERC), Nairobi. Second phase collaborative poverty Research project; 2005
20. Oyekale, A., Adeoti, A.I., T.O. Oyekale Measurement and sources of income inequality among rural and urban households in Nigeria. University of Ibadan. PMMA 2006; Working paper No. 2006-20.

21. Vanderpuye-Orgle, J. Spatial in-equality and polarization in Ghana, 1987-99. Department of Applied Economics and Management, Cornell University, NY. 2002
22. Wang, Y.Q., Tsui K.Y. Polarization orderings and new classes of polarization indices. Blackwell publishers Inc. Journal of Public Economic Theory 2000; 23:349-363
23. Wolfson, M. C. Divergent in-equality: Theories and Empirical results. Review of income and wealth. 1997; series 43, No 4, December.
24. Wolfson, M. C. "When inequalities diverge". American Economic Review. May, 1994 84(2): 353-358.
25. World Bank. Nigeria: Poverty in the midst of plenty – The challenge of growth with inclusion. Report No. 14733-UNI, Washington D.C. May. Retrieved January 10, 2008 from <http://www-wds.worldbank.org/servlet>; 1996.
26. Zhang, X., Kanbur, R. What difference do polarization measures make? An application to China. Working paper 99-02. Department of Agricultural Resource and Managerial Economics, Cornell University, Ithaca, NY. Retrieved March 20, 2008 from <http://ageconsearch.umn.edu/bitstream/123456789/29775/2/wp990002.pdf>; 1999

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