Abstract
Redistribution is a major activity of the modern nations and both policy-makers and publics are naturally curious about the impact of these efforts on the populace especially on the the poor. This study examines the impact of spatial and regional differences on the distribution of per capita expenditure in Nigeria, not only in terms of polarization, but also in terms of inequality and poverty. These and some possible dimensions around which polarization might have taken place were analysed following the identification-alienation framework. The analyses were based on data from the National Consumer Survey 1996, and National Living Standards Survey, 2004. More concern on methodology also involved the use of standard measures of inequality, Gini index and recently developed measures of polarization and bipolarization. We developed a simulation method for measuring the impact of regional variations on the level of poverty, inequality and polarization in Nigeria. The study reveals general decline in the level of inequality and polarization in the country. Indeed bi-polarization decreased between 1996 and 2004. Using a polarization index based on inequality decomposition, it is shown that the main dimensions of increasing polarization include zone, education, sector and gender. Results of simulation allow us to infer that inequality reducing policies at both intra and inter zonal levels will reduce polarization, inequality and poverty but more at intra zonal level. ..It is suggested that policies should be geared towards these dimensions in order to forestall conflicts and social tension in Nigeria.

Key words: Spatial inequality, polarization, bipolarization, wealth distribution, social tension

1.0 Introduction

1.1 The Nigeria setting

Nigeria is a country with large territory, which covers many climatic regions. The Federal Republic of Nigeria contains 36 states and the Federal Capital Territory, Abuja. This includes thirteen northern states (originally Muslim emirates), seven Middle Belt states that are home to numerous minorities and seventeen southern states, where Yoruba, Igbo and Ijaw are predominant. The states are subdivided into 774 administrative units of unequal size called Local Government Areas (LGAs). The 36 states are also grouped into six geopolitical zones that reflect mainly ethnic identity. Although, there are about 374
Identifiable ethnic groups, the country’s independent history has been marked by the rivalry between the “big three” ethno-regional clusters that, combined, represent roughly 72.7 per cent of the population: the Hausa-Fulani in the north (39.1 per cent), the Igbo in the south east (11.7 per cent) and the Yoruba in the south west (21.4 per cent). Their rivalry runs through post-independence history. Politicized tribal feelings have provoked not only a civil war in 1970 but also fear among many Nigerians that one of the three may come to dominate the whole. More than anything else, ethnicity has fostered a political culture where the struggle for inter-ethnic equity has impeded that for democratic rights – both of the individual and the group. This has been observed that, ethnically polarized societies are prone to competitive rent-seeking activities by different groups and will have difficulty agreeing on public goods such as infrastructure, education, and good policies (Alesina and Tabellini 1989; Alesina and Drazen 1991). Alesina (1994) suggests that ethnically divided societies are more prone to polarization and social conflict. Mauro (1995) finds a negative correlation between ethno-linguistic fractionalization and political stability, bureaucratic efficiency, institutional efficiency, and corruption. The aforementioned issues Duclos et al., (2004) in their work on polarization called correlates of organized, large-scale social unrest—strikes, demonstrations, processions, widespread violence, and revolt or rebellion. This may in part explain why Nigeria has produced more than $400 billion in oil revenue since the early 1970s, (International Crisis Group, 2006) but an average Nigerian is poorer today than four decades ago. Canagarajah, et al., (1997), reported increased level of poverty over the period spanning the 1980s and 1990s and inequality was established with an increase in the Gini coefficient from 38.1 per cent in 1985 to 44.9 per cent in 1992. He further remarked that the northern parts of Nigeria are the poorest compared to the
Southern parts. However, the national incidence of relative poverty dropped from 65.6 per cent in 1996 to 54.4 per cent in 2004 representing 11.2 per cent decline over the period (NBS, 2006). The disaggregation by sector showed a sharper decline in the urban areas between 1996 and 2004. In the urban areas it declined from 58.2 per cent in 1996 to 43.2 per cent in 2004, which represented a decline of 15.0 per cent. In the rural areas, it declined from 69.8 per cent in 1996 to 63.3 per cent, representing 6.5 per cent decline.

Of recent, Araar and Awoyemi (2006) estimated the contribution of each of the six geo political zones to the total inequality of 0.46 on Gini measure. The study revealed that North West zone contributes the largest share (5.2 per cent) to the national inequality while South East zone contributes the least (1.2 per cent). High potential for large regional differences in economic and social conditions makes the country susceptible to disintegration if the regional differences in standards of living continue to grow. This evidence underscores the need to go beyond conventional measures of inequality if concern is about political feasibility and continuity of reform policies as currently initiated in the country. Other reasons why inequality could have been socially embedded in Nigeria include first, the vestiges of past defective colonial economic policy. This relates to the concentration of socio-economic and other development programmes in the urban centers, where white administrators and their allies, the Nigerian elites were found, while the rural areas, where the majority of the Nigerians lived were neglected. Thus, the pivotal development advantages, which the urban centers and city dwellers enjoyed in terms of education, employment opportunities and health facilities, to mention the few, set the skewed structure of development. In other words, the dichotomy between the urban and rural areas with respect to poverty distribution, income inequality, unemployment and level
of education in part becomes explainable. Closely related to this is the strong conventional perception in the history of the country’s rural development efforts which viewed agriculture as a basis for rural development. This assumption led to national development initiatives, which have divided the country into two distinct socio-economic dichotomies - the urban and rural sectors, each of which show great diversity in natural resources endowments and the quality of life of their respective inhabitants. Further, at the root of gender dimension of inequality and poverty is unequal access and control of productive resources by men and women. For instance, in Nigeria fewer women compared to men own land because of certain socio-economic constraints, particularly, subordination of women within marriages and the lack of economic power to purchase land at the market price (Awoyemi and Adekanye, 2003).

Given this, the National question is how to structure the state so that every ethnic or religious group and every Nigerian as an individual becomes a stakeholder? How can we distinguish between the concepts of inequality and polarization and empirically document these differences in a society? What are the reasons underlying the evolution of these phenomena? How bipolar is society? How close is the distribution to the formation of two large groups, presumably identified within each and standing in antagonism to each other? How much do disparities in average living standards between zones, regions, urban and rural sectors contribute to the level of polarization, poverty or inequality in Nigeria? How will inter, intra-group inequality contribute to total poverty, inequality and polarization in Nigeria?

Thus, this study underwrites its policy relevance in developing economy of Nigeria in which economic status and social categories like ethnic groups and religion are strongly
correlated and which can be described as polarized along these dimensions. First, in order to implement appropriate institutional settings and policies that will reduce the feeling of grievance, the study will provide new information for the formulation of a more egalitarian and peaceful society as well as policies aimed at helping lagging regions. This will in particular influence the distribution of infrastructural facilities in the country. Part of the core economic reform program in Nigeria is Local Government Reforms. The aim is to promote stability, accountability, efficiency, service delivery and grassroots democracy. It is hoped that results of this study will serve as informed inputs in the formulation of policies in this direction. Second, given inequality, polarization measurements can be used to judge tax reforms (Rodríguez et al., 2005) policy. Brilliant efforts are currently been made on tax reform in Nigeria. Results from studies like this would give insight into the groups which bear the burden or benefits of government spending or tax regime. These will in-turn empower our policy makers on tax regime to adopt- progressive or regressive tax option thus, guide future deliberations on tax issues in Nigeria. Third, the marked concentrations of poor people in specific regions and/or sectors that one finds in many countries point to the importance of the pattern of growth to overall poverty reduction policy Ravallion, (2005). Fourth, the information will facilitates targeting programmes such as education, health, credit and food aid whose purpose, at least partly, is to alleviate poverty. Fifth, the information may shed light on other factors that are associated with conflicts. Sixth, this study is justified on whether new policies in the nascent democratic government in Nigeria are income-equalizing and poverty-reducing or otherwise. In specifics, this is particularly important to the policies related to the following programmes in Nigeria: National Directorate of Employment (NDE), the Family Support Program.
(FSP), Directorate for Food, Roads, and Rural Infrastructure (DFRRI), Family Economic Advancement Program (FEAP) and National Poverty Eradication Program to mention the few. Thus, the study is set to document the impact of regional differences on poverty, inequality and polarization as well as what explains their levels in Nigeria.

1.2. Poverty, inequality and polarization: different distributive concepts

Here we conceptualize inequality as the dispersion of the distribution of the attributes of the welfare indicators of our population, like income and consumption. The popular inequality measures, Gini follows Pigou-Dalton (hereafter PD) axiom that is, if one unit of income is transferred from anyone to somebody with lower income, the new distribution should be considered less unequal. All standard measures of inequality satisfy this principle. It is good to note, however, that this principle does not require that the donor be rich and the beneficiary poor. It simply says that one has to be above the other. Essentially, it measures the spread of an income distribution but fails to take into account how people of a society perceive the level of inequality D’Ambrosio (2001). It emphasizes the deviation from the global mean, ignoring clustering around local means (Zhang and Kanbur, 2001). Inequality is inversely linked with equalizing mean-preserving spreads. In other words, a set of equalizing income transfers that could lead to a bipolar density may increase polarization but decrease inequality. This motivates the independent work by Wolfson (1994) and Esteban and Ray (1994) to conceptualize the notion of polarization. So, while regional inequality addresses issues of the overall distribution of a particular regional indicator, regional polarization requires assigning those regions to a specific category based on some common characteristics of the regions and then measuring differences between those categories (Fedorov, 2002).
The concept of polarization concentrates the income distribution on several focal or polar modes, and involves the disappearance of the middle class. If a distribution is more spread out from the middle position to tails, then it indicates a higher degree of polarization. Polarization fails to satisfy the principle of transfers within polar groups, hence contrasting with inequality. It is worth noting that polarization can increase when inequality decreases (and vice versa). For instance, some transfers from the middle class to the poor and the rich can lead to both lower inequality and higher polarization (Esteban and Ray 1994). Thus, the analysis of income polarization is complementary to that of income inequality.

One particular type of polarization we addressed is the bipolarization measure, which considers only two poles. Increased bipolarity takes place if incomes below or above the middle position become closer to each other. According to Wolfson, (2004) a bipolarized income distribution is one that is spread out from the median income value, so there are fewer individual or families with middle level incomes. The conjecture that motivates research on polarization is that contrasts among homogeneous groups can cause social tension.

The literature has recently developed some indices to measure income polarization (Esteban and Ray, 1994, Wolfson, 1994, DER, 2004). These measures depend on three factors: (1) the number of groups and their relative sizes, (2) the degree of equality within each group (“identification”), and (3) the degree of income differences among groups (“alienation”). Intuitively, higher levels of identification and alienation would increase polarization.
1.3 Objectives of the study

The general objective of this study is to empirically document changes in the impact of spatial or regional differences on the distribution of per capita expenditure in terms of polarization, inequality and poverty in Nigeria. In specifics, the study objectives are to:

1. estimate the trends and levels in national and regional polarization, bipolarization and inequality of per capita expenditure distribution between 1996 - 2004 in Nigeria.
2. examine how intra, inter group inequality contribute to total poverty, inequality and polarization in Nigeria.
3. analyze how characteristics other than income explain the level of polarization in Nigeria.
4. simulate how regional differences affect inequality, polarization and poverty in Nigeria.

2.0 Literature Review

2.1 Polarization, distributive phenomenon and measurements

Income distribution has received high attention in the literature in the last few decades with a number of shifts in emphasis. The early works, starting with Kuznets, (1957) focused on within-country inequality and its links to growth, either describing how disparities influence development or explaining the pattern of inequality in any single economy as a consequence of progress. Of recent the spotlight turned to focus on discussions of the "disappearing middle class" or polarization. According to Wolfson (1994), the polarization of the distribution of a particular variable means the degree to which the population of the said distribution clusters around a series of separate poles. Several papers have argued on the differences between inequality and polarization, that the two capture different features of distribution, and can move in opposite directions (Zhang and Kanbur, 2001 and Reynal-Querol, 2002). The notion is that phenomena such as “the disappearing middle class” or “clustering around extremes” do not
appear to be easily captured by standard measures of inequality such as the Gini coefficient.

Of recent Duclos and Echevin (2005) developed a tool for ordering distributions over classes of indices that exhibit an ethical preference for the middle. As opposed to the earlier tools which concentrate on second-order bi-polarization orderings of distribution of living standards their proposed simple tests focus on the first-order bi-polarization orderings and has advantage of allowing for greater generality regarding the ethical properties of the bipolarization indices However, they acknowledged that this tool could limit the empirical ordering power of the resulting tests.

From some of these measures it has been reported that the middle income groups experienced substantially lower growth of incomes than the national average, and thus most middle class households considered themselves worse off during adjustment period (World Bank, 1996). So, whatever the cause of regional inequality, there is growing evidence of the adverse effect of this phenomenon. Lasso de la Vega and Urrutia (2006) measures show that the overall welfare level of a society is the richer group’s welfare diminished by the level of income bipolarization. That is, bipolarization can be interpreted as the welfare of the richer income group that is sacrificed to compensate for bipolarization between poorer and richer groups. Thus, in underdeveloped countries, like Nigeria it may be worth measuring income bipolarization between poor people and the rest of society.

2.2 Empirical Studies on inequality and polarization in Nigeria

In his work on the level of poverty and inequality in Nigeria Okunmadewa, (1998) remarked that there was large income inequality with the top 10 per cent of the income bracket, accounting for close to 60 per cent of total consumption of goods and services in
Nigeria. Given the depth of inequality in Nigeria, growth may not be enough without giving attention to easing inequality and eliminating barriers that constrain poor people to benefit from a growing economy and to contribute to that growth (Iwayemi et al, 2000). This could become a more intense political issue when spatial inequality is perceived to be related to discrimination against particular groups of citizens such as rural farmers (compared to urban residents), ethnic minorities concentrated in remote areas, migrants in certain districts, or religious groups in particular regions (Shorrocks and Wan 2004). Although, the issue of polarization is gaining prominence in recent discussions on income distribution, there is little or no information on this phenomenon in Nigeria. One of the earliest work was done by Aighokhan, (2000) who showed concern and alerted the country on the danger of disappearing middle class in Nigeria. He remarked that any government interested in continuity and the sustainability of its policies must show serious concern to what is happening to the middle income group.

In spite of the aforementioned reasons, studies on regional polarization are almost of no existence in Nigeria. For instance, Alayande (2003), Aighokan, (2000), Okunmadewa et al. (2006) Awoyemi and Adeoti, (2004), in all these studies, regional polarization is either not mentioned or touched in passing. Moreover, quantifying the relative role of consumption inequality and nominal income in determining the regional variations will provide answers to the heavily disputed question: which is more important for the poor, growth or redistribution?

To the best knowledge of the author, studies on regional polarization is in its very infancy and could only record the work of Aighokan, (2000) which briefly alerts on the possible problem of polarization in Nigeria. Further, studies on the link between polarization and
poverty are of no existence in Nigeria. This study has attempted to fill the gaps identified above and extended the methods earlier used by relying on the recently developed methods to assess the issue of disappearing middle class, at the national, regional, zonal and sectoral levels in Nigeria. We provide a fresh look at these issues and gave insight into the possible interventions, which could mitigate the problems of regional inequality and polarization in Nigeria.

2.3 The Theoretical Framework

*Inequality – Poverty - Polarization - Link*

The work of Ravallion (1997), in an attempt to assess the effect of inequality on the possibility of alleviating poverty in the future, gives an insight into the relationship between poverty and inequality when he presents evidence suggesting the rate of poverty reduction to be systematically lower in high-inequality countries than in low-inequality countries, because the growth elasticity of poverty reduces as the distribution worsens. Intuitively, the argument is that even if growth occurs in the context of a constant distribution - i.e. all individuals raise their income by the same proportion, the poor will receive less in absolute terms. In the extreme case of a country where all income is concentrated in the hands of one individual, neutral economic growth would have no effect whatsoever. However, if income is distributed evenly among the population, the rate of poverty reduction will be maximized by growth.

Related studies argue that poverty is a function of three factors: income inequality, as captured by the Lorenz curve, L, average income, μ, and poverty line, z (Datt and Ravallion, (1992), Shorrocks and Kolenikov, (2005), Wan, (2005), Araar and Awoyemi, (2006). Thus we can have poverty as a function of these three components.
\[ P(\mu, L, z) \]  

In the same light, Araar and Awoyemi (2006), argued that when incomes are equally distributed, the two basic poverty indices, the headcount ratio and average poverty gap depend on the difference between average income and poverty line.

Formally written as:

\[ P(\mu, z) = E_\mu + E_\pi \]  

Where \( E_\mu \) is the contribution of average income with perfect equality and \( E_\pi \) is the contribution of total inequality. What is more, they decomposed the popular measure of inequality, the Gini index across the poor and non-poor groups and relate this to the popular FGT measures of poverty indices. Formally as:

\[ I = \phi_p \psi_p I_p + \phi_{np} \psi_{np} I_{np} + \tilde{I} \]  

where \( I \) is the Gini index, \( \phi_g \) and \( \psi_g \) are the population and income shares for the group \( g \) and \( I \) respectively. \( I \) is the Gini index when within group inequality is eliminated, i.e when each household is allowed to have average income of its group. Following this, the link between head count index and the between group inequality could be specified as:

\[ H = \mu \tilde{I} \left( \frac{1}{\mu - \mu_p} \right) \]  

For the poverty gap index, the link can be expressed as:

\[ PI = \mu \tilde{I} \left( \frac{z - \mu_p}{\mu - \mu_p} \right) \]  

The link between the Gini index and severity indices of poverty is compromised by the different shapes that the distribution can have with the same level of inequality measured by it (Araar and Awoyemi, 2006). Further, the link between poverty and inequality remains
very heterogeneous and will depend *inter alia* on the precise nature of the change in inequality that is being considered. Thus not seem appropriate to think of poverty and inequality as being linked deterministically across time or space (Araar and Duclos, 2007).

**Polarization**

Since polarization is a concept distinct from inequality, it will be incorrect to use such inequality indices as Gini coefficient to measure polarization. Any polarization index should satisfy the following postulates. *Increased spread (IS):* That is a greater distancing between two groups below and above the median increases polarization, in other words regressive income transfers between groups will increase bipolarization. This axiom suggests that IS will increase both inequality and polarization. We may infer from this that this axiom may also increase the level of poverty in developing countries. *Increased Bipolarity (IB):* Increased Bipolarity takes place if incomes below or above the middle position become closer to each other, that is, progressive income transfers within groups will increase bipolarization. Since a movement from the median indicates an increase in the spread of the income distribution, polarization should increase if there are rank-preserving reductions (increments) in incomes below (above) the median income. According to IB a rank-preserving equalizing transfer between two individuals on the same side of the median increases polarization. Since inequality should reduce unambiguously under such transfer, this requirement explicitly demonstrates that polarization and inequality are two different concepts. These first two properties, IS and IB were considered, among others, by Foster and Wolfson (1992), Wolfson, (1994) and Tsui and Wang (1998). *Symmetry* means that a reordering of incomes does not change the level of polarization. An implication of symmetry is that a polarization index can be defined directly on ordered income
distributions (as we have done). It also means that: distributive indices do not depend on the individual characteristics except income. Principle of population (hereafter PP) states that if an income distribution is pooled several times, then the levels of polarization of the pooled and the original distributions are the same. Thus, PP leads us to regard polarization as a relative concept regarding population size. Evidently, PP is helpful for cross-population comparison of polarization. Note also that the median income remains unchanged under replications of the population. Finally, normalization attaches zero polarization to a perfectly equal income distribution. Continuity means that polarization will not take an abrupt jump for small changes in its argument. Thus a continuous polarization index will not be over sensitive to minor observational errors in incomes.

It is further argued that total poverty can be decomposed into the contributions of within and between group inequalities as follows:

$$P(\mu,z) = E_\mu + E_B + \sum_{g=1}^{G} E^g_{\text{W}}$$  \hspace{1cm} (6)$$

Where $E_g$ is the contribution of the between group inequality and $E^g_{\text{W}}$ is the contribution of inequality within the group $g$.

This is closely related to the work of Zhang and Kanbur (2001), who quantified polarization using an index which is derived by first decomposing the GE measure of inequality into within-group and between-group inequality. For $K$ exogenously given groups indexed by $g$, as determined by an a priori dimension, the GE measure of inequality $I$ for indicator $y$ can be decomposed into additively within-group and between-group segments.

$$I(y) = \sum_{g} w_g I_g + I(\mu_1e_1,\ldots,\mu_ke_k)$$  \hspace{1cm} (7)$$
where $I_g$ is inequality in the $g^{th}$ group, $u_g$ is the mean of the $g^{th}$ group and $e_g$ is a vector of I’s of length $n_g$, where $n_g$ is the population of the $g^{th}$ group. The first term on the right side of 9 represents the within-group inequality.

$$\frac{w_g I_g}{I(y)} \times 100$$ is the $g^{th}$ group’s contribution to total inequality. The second term is the between-group (or inter-group) component of total inequality.

The within-group inequality part in 7 represents the spread of the distributions in the subgroups; the between-group inequality is a measure of the distance between the group’s means. The ratio of between-group inequality to within-group inequality is regarded as a scalar polarization index because it captures the average distance between the groups in relation to the income differences seen within groups. As income differences within groups diminish, that is, as the groups become more homogeneous internally, differences across groups are, relatively speaking magnified and polarization is higher. Similarly, for given within groups differences, as the groups means drift apart, polarization increases. Writing more formally, we can therefore define a polarization index as:

$$P = \frac{\text{between-group inequality}}{\text{within-group inequality}}$$

where between-group inequality and within-group inequality are defined in 9

3.0 Methodology

3.1 Data requirements and sources

Data used for this study were collected by Federal Office of Statistics (FOS) Nigeria, now National Bureau of Statistics (NBS). The 1996 National Consumer Survey (NCS) data sets which are components of the National Integrated Survey of Households (NISH) as well as the recent 2004, World Bank assisted National Living Standard Survey (NLSS) data. The NISH is an ongoing programme of household surveys enquiring into various aspects of
households. These surveys were designed to provide estimate at both state and local government levels. A two-stage cluster design was employed. The population census enumeration areas (EAs) constituted the primary sampling units while the housing units were the secondary sampling units. For NLSS, a two-stage stratified sampling method was adopted. At the first stage, from each of the 36 states and the Federal Capital Territory (FCT, Abuja), cluster of 120 housing units called Enumeration area (EA) were randomly selected. The second stage involved random selection of 5 housing units from the selected EAs. A total of 600 households were randomly chosen in each state and the FCT, summing up to 22,200 households in all (NBS, 2003). Preliminary analysis of the data shows that out of the 22,200 households that were targeted, only, 19158 completed the survey. For the 1996 NCS design, in each state, a total of 120 enumeration areas (EAs), 48 urban, 12 semi-urban and 60 rural were studied. These 120 EAs were studied in the ratio 5:4:1 in the Rural, urban and Semi-Urban respectively in each state. Five household were studied in each EA per month.

4.0 Analytical techniques

4.1 Gini index

In this study an attempt is made to use a decomposition technique based on the Gini coefficient to discern the relative contribution of per capita expenditure variation in each geo political zone to the overall per capita expenditure inequality

4.2 Reasons for the indices of polarization used in this study

Although, different indices were used in this study each of them catches different aspects of polarization which will give insight into dimensions which are more pronounced and thus require more policy and research attention. For instance, Esteban and Ray (1994) (hereafter
ER) index seeks evidence for clustering in the distribution of personal income at the lower and upper ends. It tries to capture clustering along the income dimension. Besides, ER suggests dividing the population by the mean value, instead of the median value used by Wolfson.

So, the use of Wolfson measure is informed on the fact that the mean value is the income level that minimizes the average difference of income pairs within both groups and, therefore, the dispersion within each group as measured by the Gini coefficient (Davis and Shorrocks). The Wolfson bipolarization measure requires two different sets of individual utility functions, one for each income group. However, the Esteban and Ray (1994) and measures require the same utility function for all individuals.

Further, we used Esteban, Granin and Ray (1999) approach which is an extension of ER and addresses a statistical approach to measuring polarization in such a way as to deal with distributions not necessarily pre-arranged in groups. Although, polarization is still taken to be a matter of groups as in ER but in this case the given distribution is reduced into a simplified one in which the population has been concentrated on a small number of groups. Formally, the method takes the income limits defining the groups in such a way that average within-group cohesion is maximal.

Further, it is used to analyze the role of different household characteristics in the formation of groups in Nigeria expenditure distribution, e.g. educational level and zone.

Zhang and Kanbur (2001) (hereafter ZK) is considered to address the issue of socially embedded inequality in Nigeria. Economic inequality can be said to be socially embedded when the rich and the poor are distinguished not only by their wealth, but also by their language, ethnicity, race or other social characteristic. (Mogues and Carter, 2005) So, ZK
approach measure of polarization is not only concern with the income of the groups but also with other characteristics of the groups. The method could also explain how the groups are formed. They quantified polarization using the concepts of between group inequality and within group inequality for decomposable inequality measures.

Duclos, Esteban and Ray, (2004) (hereafter, DER) is based on rigorous axioms and does not depend on the number of groups. The DER method avoids the arbitrariness in the selection of groups or their income ranges as in ER. In order to do so, they developed the measurement theory of polarization for the case in which the relevant distributions can be described by density functions. In a way redefined the axioms that must be satisfied by a polarization index for continuous variables. The method also adopts distribution-free statistical inference which ensures that the orderings of polarization across entities are not simply due to sampling noise (DER, 2004).

4.3 Simulating the distributive effects of inter and intra variations in per capita expenditure distribution on sector and zones in Nigeria

Given the aforementioned characteristics and links amongst inequality, poverty and polarization the study attempts to evaluate the impact of regional variations in the distribution of per capita expenditure on poverty, inequality and polarization. To achieve this we simulate the poverty, inequality and polarization levels under the counterfactual. “What if the inter or intra zonal inequalities are suppressed?” The simulation method allows us to evaluate the potential impact of different policies meant to reduce inequality or poverty on other phenomenon like polarization. If concern is about poverty targeting and reduction effectiveness, the method will give insight into the most pronounced component of regional variations in inequality whether inter or intra regional inequality. So that, we
will be better informed about the most effective and efficient policies to focus whether intra or inter zonal inequality-reducing policies, given budget constraints. For instance, actions to reduce poverty at either local or zonal levels will be better guided by the magnitude of inequality at these levels. If intra zonal inequality is greater than inter zonal inequality, then the policy focus may be to reduce factors that may aggravate this, like massive investment on education for all, to reduce possible differential in labour opportunities among the people. If barriers to labour mobility are reduced this may reduce intra zonal inequalities. However, if inter zonal inequality is found to be greater than intra zonal inequality, policy focus may be on the distribution of infrastructure among the zones, while lagging zones should be given more attention in terms of infrastructural facilities provision. Further, the simulation will allow us to estimate the potential impact of different polices to reduce inequality or polarization on other phenomenon like poverty.

Following our simulation procedure, our first, concern is on the impact of regional differences on polarization when mean expenditure per capita across the regions is eliminated. The notion is that alienation will fall and there will also be a change in identification. Further, the magnitude of change in the bipolarization curve of Nigeria is also illustrated. Second, results of the change in poverty when differences in mean expenditures across regions disappear are presented. Again, the study presents the change in poverty incidence curve (or the cumulative distribution function) of Nigeria as a result of this.

Third, the study simulates the effect of regional differences on inequality (i.e. Gini index) in Nigeria. The concern here is the degree of change in equality when differences in mean expenditures across the regions disappeared. We also present the change in the Lorenz
curve as a result of this. In sum, we simulate the impact of changes in the distributions of per capita expenditure within and between the zones on the level of distribution as measured by the Gini index, poverty as measured by the popular FGT head count ratio, on the DER, EGR and Wolfson measures of polarization. Curiously, we are of the opinion that the above scenarios may be less of interest to the policy makers because they may not hold in practice. So, we further simulate the Gini, FGT, DER, and EGR under the counterfactual “what if the inter zonal variations in per capita expenditure is reduced by 10% or 20% at the zonal and sectoral levels?”.

4.4 The bipolarization index

4.4.1 The Wolfson bipolarization index

Further, in order to achieve estimates of bipolarization component in objective one, the study adopts the Wolfson index, which is based on the Lorenz curve and derived from the Gini coefficient (Wolfson 1997). It can be written as:

\[ W = 2(2T - Gini)/(m / \mu) \]  \hspace{1cm} (8)

where \( T = 0.5 - L(0.5) \) and \( L(0.5) \) (the value of the Lorenz curve at the 50th percentile) indicates the share of the bottom half of regions of the index, \( m \) and \( \mu \) are the median and mean respectively. An alternative way of expressing \( W \) according to Zhang and Kanbur (1999) is:

\[ W = \frac{2(\mu^* - \mu^L)}{m} \]  \hspace{1cm} (9)

Where, \( \mu^* \) is the corrected mean income: \( \mu \) multiplied by \( (1 - \text{Gini}) \), \( \mu^L \) is the mean income of the first half of the population, \( m \) is the median of the population. Maximum polarization would thus occur when half the population has zero income and the other half has twice the mean. Following Rodriguez and Salas's (2003) approach, the Wolfson bipolarization index
can be obtained by subtracting the within-groups from the between-groups Gini coefficients, computed for groups separated by the median value:

\[
P(F) = \frac{2\mu}{m} \left[ G^B(F) - G^W(F) \right]
\]

where \( m \) is the median, \( \mu \) is the mean, \( F \) is the distribution function, \( G^B \) is the between-groups Gini coefficient and \( G^W \) is the within-groups Gini coefficient, computed for groups separated by the median value. Notice that the subgroup income ranges do not overlap, and therefore there is an exact decomposition of the Gini coefficient into between-groups and within-groups contributions. It is worth noting that first, conceptually, inequality and polarization can be viewed within the same framework, with addition and subtraction of the within-groups component corresponding to inequality and polarization, respectively. Secondly, a connection between Wolfson’s concept of polarization and the polarization model of Esteban and Ray, (1994) (hereafter, ER) has been established. On the one hand, the between-groups Gini coefficient relates to the accentuation of polarization by inter-group heterogeneity. That is, \( G^B \) represents feelings of alienation between dissimilar individuals. (Alienation is positively correlated with between-groups inequality.) On the other hand, the within-groups inequality relates to the accentuation of polarization by intra-group homogeneity. Hence, \( G^W \) represents feelings of identification between similar individuals (Identification is negatively correlated with within-groups inequality).

4.4.2 The Wolfson bipolarization curves

The Wolfson polarization curve gives an indication of how "spread out" from the middle the distribution of per capita expenditure is. This polarization curve therefore plays the same "gold standard" role for the concept of polarization as the Lorenz curve plays for
inequality (Wolfson, 1997). However, the concept of polarization also has a second aspect, bimodality. This is not captured by the "distance from the median" or spreadoutness" curve, since a progressive transfer wholly on one side of the median will result in a second curve that crosses the first. However, there is a simple transformation of the spreadoutness curve that makes it simultaneously sensitive to both of these distributional attributes—spreadoutness from the middle and bimodality. It corresponds to the notion of moving from first to second order stochastic dominance. This polarization curve not only ranks any pair of distributions in exactly the same way as the "spreadoutness" curves when they do not cross. It also ranks distributions whose spreadoutness curves cross as a result purely of increased bimodality, in exactly the way desired. This polarization curve therefore plays the same "gold standard" role for the concept of polarization as the Lorenz curve plays for inequality, (Wolfson, 1997).

4.5 The polarization indices

4.5.1 The Esteban and Ray (1994) (ER) index

It is to be noted that although we will not use this method for our analysis in this study we present this method as background and basis for most of our analysis. ER contrast their measure with conventional income inequality measures. As they show, economic polarization may increase even as income inequality decreases (the two may of course also move together in some circumstances). Underlying their analysis is the contention that it is high polarization (not inequality per se) that creates the potential for costly social conflict. From this perspective, analysis of the economic costs of inequality (Alesina and Rodrik, 1994) would be better cast as analysis of the economic costs of polarization. It is assumed that a population of individuals may be grouped according to some vector of characteristics
into clusters. ER propose an index for measuring polarization based on two characteristics of the clusters: identification and alienation. The first is the attitude towards the people of the same group or income class. The identification is an increasing function of the number of individuals in each group. Polarization rises as within-group homogeneity ER, (1994). Alienation is what a person feels for somebody who is in different clusters. Polarization rises when the heterogeneity among clusters rises. Following this approach we assume that each member of the distribution with income x feels some degree of group identification with members of his own group and alienation from those with income y belonging to a different group. The interaction between both feelings gives rise to the effective antagonism that individual y feels towards x, increasing in both terms such that a higher degree of intra-group identification reinforces the effect of alienation. Polarization is defined as the addition of all effective antagonism in the distribution.

The main principles in which the axioms of ER’s measure are based are as follows: (1) The polarization rises when an extreme class gets away from the central class only if the other extreme does not get any closer. The polarization rises when the heterogeneity between groups rises. (2) When the middle class gains mass polarization declines. (3) Maximum polarization is obtained when the distribution is partitioned into two internally homogeneous groups, each one with half of the population, located at the extreme of the distribution. The polarization measure obtained from ER is expressed as:

\[
ER = A \sum_{i=1}^{k} \sum_{j=1}^{k} f(y_i)^{\alpha} f(y_j) |\bar{y}_i - \bar{y}_j|
\]

(11)

where, \(f(y_i)\) represents the population share of the \(i^{th}\) region, \(k\) is the number of regions, \(\bar{y}_i\) is the mean value of an indicator in region \(i\) and \(A\) is a normalization scalar. \(\alpha\) is the degree
of polarization sensitivity, $\alpha$ is in the range of $[1,1.6]$. The terms $|\bar{y}_i - \bar{y}_j|$ stand for the alienation – distance - felt between individuals of indicator say incomes $y_i$ and $y_j$, while $ER_i^\alpha$ stands for the sense of identification of each of the $ER_i$ members of group $i$ with their own group. Therefore, $ER_i^\alpha|\bar{y}_i - \bar{y}_j|$ is the antagonism felt by each individual of group $i$ with respect to each member of group $j$. $A$ and $\alpha$ are determined arbitrarily. The greater the value of $\alpha$ the greater deviation of the ER index from the Gini coefficient because the concentration of the groups becomes more important. When $\alpha = 0$, ER is equal to the Gini coefficient except for the income transformation used (natural logarithm). Using this measure, polarization is based on the distance between the mean income of the groups, the size of the clusters, and the degree of sensitivity to polarization. In this study we will set $\alpha$ to 1.5 to give a large weight to polarization and $A=100/\mu$, i.e, normalizing by the mean and multiplying by 100 to make the magnitude of ER comparable to Gini.

### 4.5.2 Duclos, Esteban and Ray (2004) Polarization Estimation for Continuous Distributions

Given the broad-based nature of results expected from this study we also considered the use of Duclos, Esteban and Ray (2004) method. This index allows for individuals not to be clustered around discrete income intervals, and lets the area of identification influence be determined by nonparametric kernel techniques, avoiding arbitrary choices of income ranges. The authors establish that a general polarization measure that respects a basic set of axioms must be proportional to:

$$P_\alpha(F) = \int f(y)^\alpha g(y) dF(y)$$  \hspace{1cm} (12)
where \( y \) denotes income and \( F(y) \) its distribution. The function \( g(y) \) captures the alienation effect while \( f(y)'' \) captures the identification effect. The higher the \( \alpha \) parameter, the larger the weight attached to identification in the polarization index. The value of \( \alpha \) should be set by the analyst, the policy maker or in general the person who is evaluating income polarization in a given economy. In that sense \( \alpha \) implicitly captures the value judgments of the analyst. DER follow rigorous axiomatic development of the polarization concept and estimation in the “density case”. The authors start off with \( f \) as such a density; they are interested in its polarization \( P(f) \). Following the notion of “alienation” and “identification” first, in a unidimensional polarization (\( G = 1 \)), in this case pure income polarization for each individual with income located in the support of \( f \). They presume that an individual located at \( x \), feels alienation vis-a-vis another located at \( y \), and that this alienation is monotonic in distance \( |x - y| \). It is also, presumed that an individual located at income \( x \) experiences a sense of identification that depends on the density at \( x \), \( f(x) \). (Note, \( G \) denotes the number of groups, \( x \) denotes the level of income \( x \) and \( y \) denotes the level of income \( y \)). This method is of interest as a characterized measure of polarization not only because it is a natural extension of the work of ER but also appropriate for the case of continuous distributions of our income variable. The following axioms that are satisfied by the DER index are based on a density with finite support (kernel), and symmetric reductions in dispersion that concentrate the density around its mean (squeezes).

**Axiom 1:** *if a distribution is made up of a basic density, then a squeeze cannot increase polarization.* A single squeeze, in an environment where there is just one basic component, cannot increase polarization (Duclos et al. 2002). In other words, if a distribution made up
of a population that can be scaled or undergo a slide (basic density) is collapsed inwards towards its global mean (squeeze), polarization will not increase.

**Axiom 2:** if a symmetric distribution is composed of three basic densities then a squeeze in the outer densities should not reduce polarization. Here, as opposed to axiom 1, the squeeze is local and not global and will not decrease polarization, although internal alienations in each component densities decreases, as contrast to inequality measures.

**Axiom 3:** if we consider a symmetric distribution made up of four basic densities with disjoint supports, then a move of the center distributions towards their outer neighbors, while keeping the disjoint supports, should increase polarization. This is to say that a symmetric outward slide will increase polarization.

**Axiom 4:** Given two distributions $F$ and $G$, if $P(F) \geq P(G)$, being $P(F)$ and $P(G)$ the respective polarization indexes, it must be that $P(\alpha F) \geq P(\alpha G)$ where $\alpha F$ and $\alpha G$ represent a rescaled version of $F$ and $G$. This states that if one situation exhibits greater polarization than another, it must continue to do so when populations in both situations are scaled up or down by the same amount, leaving all (relative) distributions unchanged (Duclos et al. 2002).

**Estimation method**

As in ER, effective antagonism of an individual with income $x$ towards another person of income $y$ (under $f$) could be written as $T(i,a)$ where $i = f(x)$ and $a = |x - y|$. It is assumed that $T$ is increasing in its second argument and that $T(i,0) = t(0,a) = 0$, just as in ER. Here, polarization is proportional to the “sum” of all effective antagonisms written as:

$$P(F) = \iint T(f(x),|x - y|)f(x)f(y)dxdy$$  

(13)
DER establish that a general polarization measure $P$, as described in (6), satisfies axiom 1-4 of polarization if and only if it is proportional to

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

where $\alpha \in [0.25,1]$ (14)

Concerns about estimating procedure and associated statistical inference follow DER approach which first remark that for every distribution function $F$ with associated density $f$ and mean $\mu$, we have

$$P_\alpha(F) = \int f(y)^\alpha a(y) dF(y) ,$$

with $a(y) \equiv \mu + y(2F(y) -1) - 2\int_\infty^y x dF(x)$. From our random sample size $n$ assumed to be from i.i.d observations of expenditure $y_i$, $i=1, \ldots, n$, drawn from the distribution $F(y)$ and ordered such that $y_i \leq y_{i+1} \ldots \leq y_n$. $P_\alpha(F)$ was estimated as:

$$P_\alpha(F) = \frac{1}{n} \sum_{i=1}^{n} \tilde{f}(y_i)^\alpha \tilde{a}(y_i) ,$$

where $\tilde{a}(y_i)$ is given as

$$\tilde{a}(y_i) = \tilde{\mu} + y_i (n^{-1} (2i-1) -1) - n^{-1} \left( \sum_{j=1}^{i-1} y_j + y_i \right)$$

(17)

$\tilde{\mu}$ is the sample mean, and where $\tilde{f}(y_i)^\alpha$ is estimated nonparametrically using kernel estimation procedures. It smoothes the density avoiding the noise induced by the use of a sample instead of the whole population. We estimated a function $f(y)$ over the logarithm of incomes $y=(y_1, \ldots, y_n)$ in the sample assuming that there exists an original density $f(y)$ from which the sample was extracted. We used the estimator:

$$\tilde{f}(y_i) = \frac{1}{h(y)} \sum_{i=1}^{n} K \left( \frac{y_j - y_i}{h} \right)$$

(18)
where $h(.)$ smoothing bandwidth parameters, and $K(.)$ is the kernel function, which is Gaussian in our case. These estimates were computed using the facilities in the DAD software developed and supplied by Araar, Duclos and Fortin, (2006).

4.5.3 Zhang and Kanbur (2001) index

Zhang and Kanbur (2001) developed a polarization index, which by requiring an a priori specification of clusters (groups of regions), measures the extent of inequality between these clusters, and hence, polarization in the overall distribution. It is derived from the Generalized Entropy index (hereafter GE) by decomposing it by population, in this context by regional, groups into within-group and between-group inequality and then, taking a ratio of between and within components. It captures the average distance between the groups in relation to income differences seen within groups.

$$KZ = \frac{\text{between-group inequality}}{\text{within-group inequality}}.$$  (19)

This method is particularly important in Nigeria where disparities between the regions are very important. However, one problem identified with this index is its variability. The fact that between-inequality components tend to be relatively stable, while within components vary widely, makes the index very unstable (Mabel et.al, 2002). A useful benchmark for this index is 1 where the contributions of both types of inequality to total inequality are the same.

A modification of Kanbur–Zhang index where it is defined as a ratio of between-group inequality to total inequality may serve better as a polarization index for the following two reasons. First, if within-group inequality is small, then even small changes in within-group inequality from one period to another will lead to large swings in the values of the KZ index. Second, the modified KZ index has an intuitive interpretation as the share of between-group inequality in total inequality. If one suggests several possible polarization
dimensions, i.e., regional groupings, then the KZ index (or the modified KZ index) can be used to determine along which dimension the regions are becoming more polarized.

4.5.4 The socio demographic groups and polarization

4.5.4.1 Sub-population groups and polarization, the EGR (2000) method

Further on the dimensions of polarization, we assume that groups are determined by a characteristic that their members share, not only on income, but also on the basis of other relevant attributes, as it is possible that there exists a high correlation between income and other characteristics. The main aim for the use of Esteban, Gradin and Ray (hereafter, EGR) here is to explain how the characteristic (for example the education level, sector, gender) explains the polarization. But, it is good to note that the ER measure presupposes that the population is already structured into groups. This creates some difficulties for its mechanical application to distributions over variables that, like income, take on a large number of values.

In order to correct this, ERG 1999 improved on this method to measure continuous distribution. Before applying this measure it will be necessary to define a simplified representation of the original distribution in a set of k exhaustive and mutually exclusive groups, \( \rho = (z_0; z_1; \ldots; z_k; \mu_1; \ldots; \mu_k; p_1; \ldots; p_k) \), the boundaries of which are given by per capita income intervals of the form \([z_{i-1}; z_i]\), for \( i = 1; \ldots; k \). This will involve certain degree of error, however, as this partition will generate some loss of information, depending on the level of per capita income dispersion in each of the groups considered.

Taking into account this idea, the measure of generalized polarization proposed by EGR is obtained after correcting the \( P_{ER} \) index applied to the simplified representation of the original distribution with a measure of the grouping error, \( e(f', \rho) \). That is,
\[ P^{EGR}(f, \alpha, \rho, \beta) = P^{ERP}(f, \alpha, \rho) - \beta \epsilon(f, \rho) \tag{20} \]

Where \( \beta \geq 0 \) is a parameter that informs on the weight assigned to the error term in expression (20).

It is to be noted that when dealing with personal or spatial income distributions, there are no unanimous criteria for establishing the precise demarcation between the different groups (Carlos Gil and Pascua, 2005). To address this problem, EGR use the algorithm proposed by Davies and Shorrocks (1989) in order to find the optimal partition of the original distribution in a given number of groups, \( \rho^* \). This means selecting the partition that minimizes the Gini index value of within-group inequality, \( G(f) - G(\rho^*) \).

Given that \( \epsilon(f, \rho^*) = G(f) - G(\rho^*) \), the measure of generalized polarization proposed finally by EGR, therefore, can be expressed as:

\[ P^{EGR}(f, \alpha, \rho^*, \beta) = P^{EGR}(f, \alpha, \rho^*) - \beta \left[ G(f) - G(\rho^*) \right] \tag{21} \]

We denote by \( EP^* \) the level of polarization associated to \( \rho^* \), according to expression (21).

Following Gradin, 2000 we generated three partitions for our population based on a particular characteristic like sector or zone. For instance, let a collection of numbers denote as \( \rho^* = (q_1, \ldots, q_n; m_1, \ldots, m_n) \), represent this partition where \( q_i \) indicates the population share in group \( i \) and \( m_1 \leq m_2 \leq \ldots \leq m_n \) indicate respective groups’ average incomes. The distribution of each sub-population is given by the share of people in the \( i \)-th group with per capita expenditure of at least \( y \), \( F_i(y), i = 1, \ldots, n \), such that for any per capita expenditure \( y \):

\[ F(x) = \sum_{i=1}^{n} F_i(x)q_i \tag{22} \]

and for each \( i \): \( m_i = \int_a^b x dF_i \). \tag{23}
\[ EP^*(f, \alpha, \rho^+, \beta) = P_{ER}^*(f, \alpha, \rho^+) - \beta \left[ G(f) - G(\rho^+) \right] \]  

(24)

In order to account for the share of polarization explained by the characteristic, Gradin (2000) normalizes the above expression in such a way as to obtain the following index:

\[ EP(f, \alpha, \rho^+, \beta) = \frac{EP^+ - EP_{\min}^+}{EP_{\max}^+ - EP_{\min}^+} \]  

(25)

Where \( EP_{\max}^+ \) and \( EP_{\min}^+ \) are, respectively, the maximum and minimum values, that, given \( f \), are possible to obtain with \( EP^+ \). In fact, the maximum is reached when \( \rho^+ = \rho \), while the minimum occurs when there is no difference in the average per capita incomes of the various subgroups. That is, \( EP_{\min}^+ = P_{EGR}^*(f, \alpha, \beta, \rho) \) and \( EP_{\max}^+ = -\beta G(f) \).

(26)

Therefore, \( EP(f, \alpha, \rho^+, \beta) = \frac{P_{ER}^*(f, \alpha, \rho^+) + \beta G(\rho^+)}{P_{ER}^*(f, \alpha, \rho) + \beta G(\rho^+)} \)  

(27)

Likewise, for the special case of bipolarization, when we consider the optimal partition \( \rho^+ \) and with \( \alpha = 1 \), the expression (27) can be written as:

\[ EP(f, \alpha, \rho^+) \frac{G(\rho^+)}{G(\rho)} \]  

(28)

Using this method we also examined the evolution of polarization in the zonal per capita expenditure distribution in Nigeria by means of the information provided by a partition of the original distribution in three groups. In order to check the robustness of the results, we considered different degrees of sensitivity to polarization in our analysis. Specifically \( \alpha = 1; 1:3; 1:6 \) sensitivity.

So, in order to analyze the degree of polarization in this study, we first obtain the simplified representation of the original distribution into a three number of groups. This simplified representation consists of the representative per capita expenditure of each group.
and its population. This information *per se* is quite useful in understanding the essential features of any given distribution. We also obtain the residual within-group inequality telling us about how well defined –i.e. internally cohesive- groups are. We finally compute the polarization corresponding to the simplified distribution and deduct internal group dispersion. This we did with the STATA software

4.6 Polarization components and poverty

4.6.1 Bipolarization-Poverty Link

It has been showed that bipolarization and poverty measures are closely related when the income value used to separate income groups represents the poverty line (Rodríguez, 2006). Thus, instead of dividing the income distribution into two income groups based on median or mean incomes, it will be more appropriate to use the poverty line to measure income bipolarization. In that case, bipolarization between the poor and others in the income distribution explicitly considers the value of a poverty index known as the normalized poverty deficit index. In fact, the ER index depends on the normalised poverty deficit index, whether the poverty line is the mean income and the identification sensitivity parameter is unity. To link the Wolfson bipolarization index to poverty measures, let the poverty line, $z$, be the income level that divides the income distribution in two groups. In this case, bipolarization between poor people and others is explicitly based on a poverty index. For instance, if we recall that the Sen index is:

$$S^S_z(F) = H_z(F)\left[I_z(F) + (1 - I_z(F))G_p\right]$$

where $z$ is poverty line, $H_z(F) = q_2$ is the headcount ratio or the proportion of the population who are poor in $F$, and $I_z(F) = 1 - \frac{\mu P}{z}$ is the income gap ratio (Sen, 1976). Wolfson polarization measures is also a function of the normalized poverty deficit index, which belongs to the Foster–Greer–Thorbecke family of
poverty measures \cite{Foster1984}.

\[ T_{z}^{FGT}(X : \gamma) = \frac{1}{2} \sum_{i=1}^{n} \Gamma(x_i)^\gamma \text{ where } \Gamma(x_i) = \max \left\{ \frac{z-x_i}{z}, 0 \right\} \text{ and } \gamma \geq 0 \]. This family of poverty measures is the normalized poverty deficit index or the product of the headcount and income gap ratios, \( D_z(x)/z = \pi_z I_z(x) \), when \( \gamma = 1 \).

Following Rodriguez, \cite{Rodriguez2004}, if \( F \in \mathbb{R}^n \) be an income distribution, let \( GP_z(F) \) be the Generalized Wolfson polarization measure and let \( S_z^S(F) \) be the Sen poverty measure. Then we have:

\[
GP_z(F) = q_z \left( S_z^S(F) - q_z \frac{\mu_D}{\mu_p} G_p \right) + (1 - q_z) R_z(F) \frac{\mu}{\mu} G_z^{w}(F)
\]  

(29)

Where \( G_p \) is the Gini coefficient for the poor income group, \( R_z(F) \) is the normalized wealth index and \( G_z^{w}(F) \) is the within –groups Gini coefficient.

### 5.0 Results and discussion

Table 1 and Table 2 present the summary statistics of the key variables in 1996 NCS and 2004 NLSS data sets used in this study. The tables show how the country is grouped into zones and sectors with similar geopolitical characteristics. For consistency, where necessary the study follows the four zones as in 1996 NCS data set but later focus more on, 2004 NLSS data set with its six geopolitical zones. Sectoral analysis was based on the rural and urban sectors.

Based on the distribution of per capita expenditure among the four zones in 1996, South East zone has the highest average per capita expenditure of one thousand, five hundred and sixty eight naira, fifty four kobo (N1568.54), followed by the South West zone with average per capita expenditure of one thousand, two hundred and ninety three naira, sixty
five kobo (N1293.65) while North East zone has the least average per capita expenditure of one thousand and thirty seven naira seven kobo (N1037.067). Since 1996 there has been an increase in the gap to 59.28 per cent in 2004. South West zone seems to be the most vibrant economy with the highest per capita expenditure of forty thousand three hundred and fifty three naira eighty three kobo (N40353.83) in 2004, followed by the South East zone with per capita expenditure of thirty nine thousand eight hundred and forty nine naira, eighty five kobo (N39849.85) while North West zone has the lowest per capita expenditure of twenty three thousand and eighty seven naira, twelve kobo (N23987.126). It is still evident that the rural sector in Nigeria is virtually neglected with its poor economic structure. In both 1996 and 2004, the poor level of per capita expenditure reflects the depth of poverty in this sector.

Table 1 Summary statistics of the key variables used – 1996 NCS

<table>
<thead>
<tr>
<th>Zone</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>North East</td>
<td>1895</td>
<td>28.40</td>
<td>31732.36</td>
<td>1037.0665</td>
<td>1613.06</td>
</tr>
<tr>
<td>North West</td>
<td>2547</td>
<td>10.56</td>
<td>41649.45</td>
<td>1084.3807</td>
<td>1752.53</td>
</tr>
<tr>
<td>South East</td>
<td>2751</td>
<td>47.03</td>
<td>37181.25</td>
<td>1568.5384</td>
<td>2211.63</td>
</tr>
<tr>
<td>South West</td>
<td>2182</td>
<td>36.15</td>
<td>34319.17</td>
<td>1293.8459</td>
<td>1986.42</td>
</tr>
<tr>
<td>Sector</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>2001</td>
<td>10.56</td>
<td>41649.45</td>
<td>1464.6068</td>
<td>2367.35</td>
</tr>
<tr>
<td>Rural</td>
<td>7374</td>
<td>10.56</td>
<td>41649.45</td>
<td>998.8625</td>
<td>1513.37</td>
</tr>
<tr>
<td>Total</td>
<td>9375</td>
<td>10.56</td>
<td>41649.45</td>
<td>1098.2710</td>
<td>1741.71</td>
</tr>
</tbody>
</table>

Table 2 Summary statistics of the key variables used – 2004 NLSS

<table>
<thead>
<tr>
<th>Zone</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>North East</td>
<td>4722</td>
<td>850.01</td>
<td>1717056.40</td>
<td>27720.1546</td>
<td>39400.83201</td>
</tr>
<tr>
<td>North West</td>
<td>5796</td>
<td>1790.03</td>
<td>495542.32</td>
<td>23087.1163</td>
<td>24347.66965</td>
</tr>
<tr>
<td>South East</td>
<td>4613</td>
<td>975.22</td>
<td>1799974.00</td>
<td>39849.8502</td>
<td>42854.66055</td>
</tr>
<tr>
<td>South West</td>
<td>4027</td>
<td>1334.23</td>
<td>2205154.50</td>
<td>40353.8265</td>
<td>52591.32471</td>
</tr>
<tr>
<td>Sector</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>4646</td>
<td>1334.23</td>
<td>2205154.50</td>
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<tr>
<td>Rural</td>
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<td>1799974.00</td>
<td>28527.8287</td>
<td>32434.71040</td>
</tr>
<tr>
<td>National</td>
<td>19158</td>
<td>850.01</td>
<td>2205154.50</td>
<td>31894.7549</td>
<td>40538.26017</td>
</tr>
</tbody>
</table>
5.1 Gini inequality

In order to provide good benchmarking values, the study adopts the most referred Lorenz-based Gini Coefficient measure of inequality. This allows us to have insight into the trends in zonal and sectoral inequalities. Table 3 provides a list of the different Gini co-efficient by zone, and sector. The Gini coefficient is quite straightforward to compute and fairly easy to interpret. It varies from zero (all units have equal income) to 1 (maximum inequality).

As can be seen from Table 3 there has been a general decrease in the level of inequality from 1996 to 2004 in Nigeria. The national percentage decrease is about 17 per cent. Both rural and urban sector show general decline in the level of inequality but at a faster rate in urban sector. Further, all the four zones show considerable per cent decrease in the level of inequality from 1996 to 2004, but at a higher magnitude in the southern zones.

<table>
<thead>
<tr>
<th>Sub-groups</th>
<th>1995/96</th>
<th>2003/04</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sector</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>0.51</td>
<td>0.41</td>
</tr>
<tr>
<td>Urban</td>
<td>0.55</td>
<td>0.44</td>
</tr>
<tr>
<td><strong>Geopolitical zones</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North east</td>
<td>0.54</td>
<td>0.42</td>
</tr>
<tr>
<td>North west</td>
<td>0.50</td>
<td>0.43</td>
</tr>
<tr>
<td>South east</td>
<td>0.52</td>
<td>0.39</td>
</tr>
<tr>
<td>South west</td>
<td>0.53</td>
<td>0.45</td>
</tr>
<tr>
<td><strong>National</strong></td>
<td>0.53</td>
<td>0.44</td>
</tr>
</tbody>
</table>

5.2 Polarization: Evolution and Causes

*Evolution*

It is shown that polarization measures provide information that inequality measures do not, adding important insights for the analysis of sectoral and zonal income dynamics. Table 4 presents results of DER measures of polarization available for this report. It is evident that
there is a general decline in the level of polarization between the period of 1996 and 2004 with DER measure of 0.30 and 0.25 in 1996 and 2004 respectively. Polarization declined by about 17 per cent at the national level, Alienation component of the polarization shows a faster decrease than identification component. In spite of the slight decrease in the total level of polarization within this period, level of identification is still very high at about 0.73. This suggests tendency for increased bipolarization. Rural sector seems to be more polarized in 1996 than in 2004 but declined to the same level with urban sector in 2004. Although, there is general decline in alienation feelings among the zones, there is increase in the identification feelings among the zones between 1996 and 2004 except the south west zone.

Table 4: Duclos, Esteban and Ray (DER) analysis of polarization

<table>
<thead>
<tr>
<th>Sub-groups</th>
<th>1996</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>Alienation</td>
</tr>
<tr>
<td>Sector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>0.31</td>
<td>0.55</td>
</tr>
<tr>
<td>Urban</td>
<td>0.29</td>
<td>0.51</td>
</tr>
<tr>
<td>Geopolitical zones</td>
<td></td>
<td></td>
</tr>
<tr>
<td>North east</td>
<td>0.31</td>
<td>0.54</td>
</tr>
<tr>
<td>North west</td>
<td>0.28</td>
<td>0.50</td>
</tr>
<tr>
<td>South east</td>
<td>0.30</td>
<td>0.52</td>
</tr>
<tr>
<td>South west</td>
<td>0.30</td>
<td>0.53</td>
</tr>
<tr>
<td>National</td>
<td>0.30</td>
<td>0.53</td>
</tr>
</tbody>
</table>

5.3 Bi-Polarization

This section of the study underwrites its importance because of the large proportion of poor people in Nigeria society. It is worth measuring bipolarization between the rich and poor, rural and urban. This will give more insight into the persistent conflicts and unrest in the country. Table 5 displays results of Wolfson bi-polarization measures in Nigeria for 1996
and 2004 data sets, for national, zones and sectors. It can be observed that, perhaps Nigeria economy is tending towards a convergence. Indeed bi-polarization decreases between 1996 and 2004 as can be seen in Table 5. There seems to be fewer individuals or families with middle level incomes in the North West 0.44 and 0.38 in 1996 and 2004 respectively and South West zones 0.51 in 1996 and 2004, than in the North East 0.51 and 0.35 in 1996 and 2004 respectively and South East zones 0.53 in 1996 and 2004. So, these zones with evidence of middle class disappearance have tendency towards bimodality. In other words, a clumping of formerly middle level incomes at either higher or lower levels of per capita expenditure.

Table 5: Wolfson analysis of bipolarization -2004

<table>
<thead>
<tr>
<th>Sector</th>
<th>Geopolitical zones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rural</td>
</tr>
<tr>
<td>1996</td>
<td>0.49</td>
</tr>
<tr>
<td>2004</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Overall, the results reveal decreases in polarisation through the period at the national, zonal or sectoral levels in Nigeria.

5.4 Dimensions of Polarisation

5.4.1 Zhang and Kanbur Approach

Unlike measures discussed above which only provide information about the existence, dynamics and degree of polarization with little or no information about the nature of polarization here, some possible dimensions around which polarisation may have taken place are examined and discussed. Zones or sectors may have been clustered around a dimension common to them. This will give us more insight into the nature of polarization.
Kanbur and Zhang (1999, 2001) have proposed an index for measuring polarization around *a priori* determined dimensions which may tell us more about the nature of the process. Their index is derived from Theil’s Generalized Entropy (hereafter, GE) measure and is based on the property of GE being additively decomposable. For our dimensions we have employed three measures: zones, quality of education, gender, and sector as our dynamic poles around each of which polarisation may have taken place.

Table 6 shows the results for the dynamic dimensions for our variables. Within-group and between-group contributions to inequality are presented. The KZ index is also provided. There is considerable polarisation around the dimension of zone and education. High between group inequality coupled with low within group inequality has resulted in high KZ index for these two dimensions. This is a strong indication of polarisation around these dimensions. It is observed that for all dimensions considered, increase in between inequality outweighs the general decrease in within inequality. Consequently, there is general increase in the level of polarization around all dimensions considered.

In ER’s terminology, these are *identification* and *alienation* components which have increased the polarization in these dimensions. Therefore policies must be geared towards reducing polarization around zone, education, sector and gender dimensions to alleviate social tension and conflicts in Nigeria.

**Table 6: Between- and Within-group gini and Zang and Wan indices**

<table>
<thead>
<tr>
<th>Sub-groups</th>
<th>1996</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Between-group gini</td>
<td>Within-group gini</td>
</tr>
<tr>
<td>Sector</td>
<td>0.0492</td>
<td>0.3129</td>
</tr>
<tr>
<td>Zones</td>
<td>0.079</td>
<td>0.1263</td>
</tr>
</tbody>
</table>
5.4.2 EGR Approach

Here again, we assume that despite polarization occurring in the income space, groups in the distribution are the result of similarities with respect to a relevant attribute other than income, sector- rural and urban. This would be useful to be able to explain what would change if we assume that groups in society share certain attributes other than the level of expenditure.

Table 7 shows results of impact of regional variations in the distribution of per capita expenditure as calculated using EGR approach. According to the results, we infer that in 2004, the contribution to polarization by the dichotomy between rural and urban sectors decreased from 0.11 to 0.04 when inter group and intra group variations were removed respectively. The results suggest that policies directed toward the reduction of inequalities within the sectors will be more effective and efficient in polarization alleviation than policies directed at reducing inequalities between rural and urban sectors. It is interesting to note that although both rural and urban sector contribute less to polarization when inequalities within the sectors are removed urban sector plays slightly lesser role when intra group inequalities are removed than when between group inequalities are removed.
Table 7: Esteban, Granin and Ray, (1999) Approach Results

<table>
<thead>
<tr>
<th>2004</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>G(f)</td>
<td>(\rho^*)</td>
<td>Error</td>
<td>EGR Index</td>
</tr>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Inter-Group Ineq</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sector</td>
<td>LB - UB</td>
<td>LB – UB</td>
<td>LB - UB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>935.836 - 17166.877</td>
<td>17166.877 - 33973.137</td>
<td>33973.137 - 1374940.625</td>
<td>0.372</td>
<td>0.322</td>
<td>13.26%</td>
<td>0.064</td>
</tr>
<tr>
<td>Urban</td>
<td>1115.352 - 23982.955</td>
<td>23982.955 - 52052.664</td>
<td>52052.664 - 1993604.750</td>
<td>0.427</td>
<td>0.369</td>
<td>13.56%</td>
<td>0.074</td>
</tr>
<tr>
<td>Population</td>
<td>935.836 - 17166.877</td>
<td>17166.877 - 33973.137</td>
<td>33973.137 - 1374940.625</td>
<td>0.372</td>
<td>0.322</td>
<td>13.26%</td>
<td>0.106</td>
</tr>
<tr>
<td>No Intra-Group Ineq</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sector</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>24033.398 - 25658.791</td>
<td>25658.791 - 33900.359</td>
<td>33900.359 - 37748.801</td>
<td>0.093</td>
<td>0.090</td>
<td>3.87%</td>
<td>0.024</td>
</tr>
<tr>
<td>Urban</td>
<td>24033.398 - 25609.785</td>
<td>25609.785 - 33916.355</td>
<td>33916.355 - 37748.801</td>
<td>0.092</td>
<td>0.088</td>
<td>4.33%</td>
<td>0.023</td>
</tr>
<tr>
<td>Population</td>
<td>24033.398 - 25658.791</td>
<td>25658.791 - 33900.359</td>
<td>33900.359 - 37748.801</td>
<td>0.093</td>
<td>0.090</td>
<td>3.87%</td>
<td>0.035</td>
</tr>
</tbody>
</table>
5.4.3 With and without inter and intra zonal inequalities

Here, attempt was made to explain the influence of regional variations on the level of inequality as measured by Gini when inter-zonal and intra-zonal inequalities in the distribution of per capita expenditure were suppressed. The results are illustrated in Table 8. Expectedly, the level of inequality is unaffected with both inter and intra groups inequalities. However, there is a remarkable difference when either inter or intra zonal inequalities were removed, particularly intra zonal variations. The level of national inequality is as high as 0.411 when inter zonal variations were removed but decreased to 0.096 when intra zonal variations were removed. It is evident that, in 2004, the difference between with and without inter zonal and intra zonal differences are 0.011 and 0.326 respectively. The point to make is that efforts toward reducing inequalities within the zones will be more effective and efficient than focusing on reducing inequalities among the zones. Fig 1 presents the graphic illustration of this.

Table 8: Differences in the Gini when inter and intra zonal differences were removed (standard errors are in parenthesis)

<table>
<thead>
<tr>
<th></th>
<th>Inter-zonal differences</th>
<th>Intra zonal differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With</td>
<td>0.422</td>
<td>0.422</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.0003)</td>
</tr>
<tr>
<td>Without</td>
<td>0.411</td>
<td>0.096</td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>Difference</td>
<td>-0.011</td>
<td>-0.326</td>
</tr>
</tbody>
</table>
Similarly, we attempt to account for the impact of zonal variations in the distribution of per capita expenditure on the level of poverty as measured by the three popular indices of FGT measures of poverty: head count ratio, poverty gap and poverty severity. Table 9 shows results of with and without inter zonal variations on the level of poverty first at the national level, then on zonal and sectoral basis. Generally, there is a slight decrease in the level of the three indices of FGT when inter zonal inequalities were removed. Taken head count ratio as unit of our poverty measure, the percentage change in the national poverty with and without inter zonal variation is negative, which suggests that even with the removal of inter zonal inequalities the level of poverty is still high. It is evident that policies meant to remove inter zonal variations will have different impact on the zones in Nigeria. It is interesting to note that all the Southern zones show positive percentage change while all the Northern zones and rural sector show negative percentage change. This suggests that while
such policies might bring considerable reduction in poverty to the Southern zones they may have lesser impact on the rural sector and Northern zones. So, in addition to policies target at reducing inter zonal inequalities Northern zones and rural sector will need more facilities or resources to reduce poverty than Southern zones. Fig 2 presents graphical illustration of head count poverty level when inter zonal inequalities were removed and why removal of intra zonal inequalities presents no impact. Table 6 in the appendix shows similar results for 1996, while Fig 6 presents graphical illustration of poverty gap and severity.

Table 9: 2004 FGT Poverty measures (standard errors are in parenthesis)

<table>
<thead>
<tr>
<th>Poverty measures</th>
<th>With zona differences</th>
<th>Without inter-zona differences</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>α=0</td>
<td>α=1</td>
</tr>
<tr>
<td>South south</td>
<td>0.402</td>
<td>0.134</td>
</tr>
<tr>
<td>South east</td>
<td>0.244</td>
<td>0.067</td>
</tr>
<tr>
<td>South west</td>
<td>0.349</td>
<td>0.139</td>
</tr>
<tr>
<td>North central</td>
<td>0.521</td>
<td>0.220</td>
</tr>
<tr>
<td>North east</td>
<td>0.578</td>
<td>0.218</td>
</tr>
<tr>
<td>North west</td>
<td>0.540</td>
<td>0.205</td>
</tr>
<tr>
<td>Sector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>0.538</td>
<td>0.208</td>
</tr>
<tr>
<td>Urban</td>
<td>0.335</td>
<td>0.119</td>
</tr>
<tr>
<td>Population</td>
<td>0.448</td>
<td>0.169</td>
</tr>
</tbody>
</table>
Table 10 shows results of with and without inter zonal variations using DER polarization measures. The results reveal slight difference of 0.007 and 0.003 in 2004 and 1996 respectively. Generally, identification component accounts for the major part of polarization.

**Table 10: DER Polarization when inter zonal differences were removed 1996 and 2004**

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th></th>
<th>1996</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Alienation</td>
<td>Identification</td>
<td>Total</td>
</tr>
<tr>
<td>With</td>
<td>0.245</td>
<td>0.411</td>
<td>0.736</td>
<td>0.281</td>
</tr>
<tr>
<td>Without</td>
<td>0.238</td>
<td>0.395</td>
<td>0.743</td>
<td>0.278</td>
</tr>
<tr>
<td>Difference</td>
<td>0.007</td>
<td>0.016</td>
<td>-0.007</td>
<td>0.003</td>
</tr>
</tbody>
</table>

**5.4.4 Simulation results**

As useful as the above analyses and results are, we are of the opinion that for policy reasons it may be more reasonable and acceptable to think of changes in regional variation
by certain percentages. Since, policy effects are gradual and may be unrealistic to think of total removal of regional variations as earlier discussed. Table 11 shows results of simulated inequality as measured by the Gini index, poverty as measured by the headcount ratio, polarization as measured by DER and EGR polarization approaches when intra and inter regional inequalities are reduced by 10 and 20%.

Consistent with the earlier results, simulation models results carry negative signs which indicate that the levels of inequality, poverty and polarization as measured by the Gini, headcount ratio, DER measure of polarization and EGR measure of polarization respectively, will decrease as both intra and inter zonal inequalities are removed, but more decrease results with the decrease in intra zonal inequalities. It is evident from Table 9 that more poverty, inequality and polarization will be removed as percentage reduction in both intra and inter zonal inequalities increases. Fig 3 presents graphic illustrations of the simulation results when alpha is zero and more illustrations are in the appendix 1.

Table 11: Simulation results (standard errors are in parenthesis)

<table>
<thead>
<tr>
<th>Percentage reduction</th>
<th>Without Intra zonal inequality</th>
<th>Without Inter zonal inequality</th>
<th>GINI</th>
<th>FGT</th>
<th>DER</th>
<th>EGR</th>
<th>GINI</th>
<th>FGT</th>
<th>DER</th>
<th>EGR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>SECTOR</td>
<td>-0.002</td>
<td>-0.002</td>
<td>-0.001</td>
<td>-0.001</td>
<td>-0.039</td>
<td>-0.030</td>
<td>-0.012</td>
<td>-0.012</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.000)</td>
<td></td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ZONE</td>
<td>-0.002</td>
<td>-0.002</td>
<td>-0.001</td>
<td>-0.002</td>
<td>-0.039</td>
<td>-0.030</td>
<td>-0.012</td>
<td>-0.012</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.000)</td>
<td></td>
<td>(0.001)</td>
<td>(0.002)</td>
<td>(0.000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>SECTOR</td>
<td>-0.005</td>
<td>-0.003</td>
<td>-0.002</td>
<td>-0.002</td>
<td>-0.078</td>
<td>-0.069</td>
<td>-0.025</td>
<td>-0.023</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.000)</td>
<td>(0.002)</td>
<td>(0.000)</td>
<td></td>
<td>(0.001)</td>
<td>(0.003)</td>
<td>(0.000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ZONE</td>
<td>-0.078</td>
<td>-0.004</td>
<td>-0.002</td>
<td>-0.002</td>
<td>-0.078</td>
<td>-0.068</td>
<td>-0.025</td>
<td>-0.023</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.000)</td>
<td></td>
<td>(0.001)</td>
<td>(0.003)</td>
<td>(0.000)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fig 3

Impact of 10% reduction of inter-zonal inequality on sector ($\alpha = 0$)

Impact of 20% reduction of inter-zonal inequality on sector ($\alpha = 0$)

Impact of 10% reduction of intra-zonal inequality on sector ($\alpha = 0$)

Impact of 20% reduction of intra-zonal inequality on sector ($\alpha = 0$)
6.0 CONCLUSION

The similarities and differences between inequality and poverty measures are well known, but we know little about the meaning of income polarization in terms of poverty and inequality. In this study, the relationship between these measures is focused in terms of
their measurements and trends in their evolution between 1996 and 2004 in Nigeria. First, the study considers traditional analysis of the inequality component of the income distribution and polarization which is the other relevant aspect which has been almost unconsidered in Nigeria. Second, one particular type of polarization we examined is the bipolarization measure, which considers only two poles. Bipolarization measures will be considered as an indicator of “a hollowed out middle” or disappearance of the middle class in Nigeria. Further, bipolarization is linked to poverty which is the other primary features of an income distribution. Using 1996 Nigeria Consumer Survey data and 2004 World Bank assisted National Living Standard Survey data we are able to find declining trend of polarization measures in Nigeria.

The results point to the fact that economic activities in the Southern zones seem better off than economic activities in the Northern zones. Going by the Gini results we could safely say that redistribution policies in Nigeria are yielding fair results as evidenced by the decrease in the level of inequality from 0.53 in 1996 to 0.44 in 2004. This decline is also true for polarization measure as presented by the results of DER. However, it is evident that the alienation component of polarization is on the increase. This calls for a concern on possible increase in the level of polarization if the trend is not checked.

Zone and education rank high among dimensions on which polarization is growing in Nigeria. Other dimensions suspected include sector (rural and urban) and gender. From the policy point of view, it is evident from this study that policies aim at reducing within group inequalities will be more effective and efficient than policies aim at reducing inequalities between or among the groups.
Further, Southern zones seem to be more sensitive to inter zonal reduction of inequalities than the Northern zones. This suggests that Northern zones will require more resources to alleviate their poverty than southern zone, even when inter zonal inequalities are removed among the zones. In sum, policies aim at reducing inequality within different groups in the country has high potential to reduce not only poverty but polarization, thus prevent social conflicts and tension.
REFERENCES
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Appendix 1

Impact of 10% reduction of inter-zonal inequality on sector ($\alpha = 1$)

Impact of 10% reduction of intra-zonal inequality on sector ($\alpha = 1$)

Impact of 20% reduction of inter-zonal inequality on sector ($\alpha = 1$)

Impact of 20% reduction of inter-zonal inequality on sector ($\alpha = 1$)