SOURCES OF INCOME INEQUALITY AND POVERTY IN RURAL AND URBAN NIGERIA

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ABSTRACT

Income inequality is detrimental to economic growth and development. In Nigeria, several studies have shown that income inequality is increasing in the rural and urban areas, and this can be linked to the growing dimension of poverty. This study therefore attempts to estimate the level of income inequality using the data from National Integrated Households’ Survey collected by the Federal Office of Statistics (FOS) in 2003. The mean, standard deviation, and coefficient of variation will be used to describe the distribution of households’ incomes, while Gini-coefficient will be used to measure income inequality. Also, decomposition of income sources into agricultural, livestock, rental, transfer, and non-farm incomes will be done using the Coefficient of variation and Gini-coefficient. The socio-economic determinants of per capita income, which is a measure of welfare, will be derived through an Ordinary Least Square (OLS) regression. This approach will be used to decompose the effect of some socio-economic variables on inequality. The z-statistics and t-statistics will be used to test some stated hypotheses.

1. INTRODUCTION

The pattern of income distribution has been a concern to economists for a long time (Clarke et al, 2003). Specifically, the 1990s witnessed resurgence in theoretical and empirical attention by economists to the distribution of income and wealth (Atkinson and Bourguignon, 2000). This is because high level of income inequality produces an unfavourable environment for economic growth and development. Previous studies have shown that income inequality has risen in many developing countries over the last two decades (Addison and Cornia, 2001; Cornia with Kiiski, 2001; Kanbur and Lustig, 1999). The widening dimension of poverty has aroused serious humanitarian concerns and fears.
of political instability. It has therefore become evident that in absence of strong foreign markets, the domestic inter-sectoral linkages and policy environment required for rapid economic growth cannot be provided by policies which result in further concentration of national income in the hands of few proportion of the population (Aigbokhan, 1999; Clarke et al, 2003).

Despite the commitments already shown by many developing countries towards the achievement of the goal of reducing income inequality, efforts geared at achieving this have been greatly hindered by insufficient knowledge of how to design appropriate policies that would call for broad participation, the modality of their implementation procedures and measurement of the overall impact on the economy (Matlon, 1979). Many empirical studies have assessed the impact of some macro-economic policies on economic development based on the level of income inequality during the periods of their implementation. A common model proposed has explained this secular trend based on inter-sectoral income differentials and changes in the incomes of the citizenry resulting from the growth processes (Matlon, 1979; Ahluwalia, 1976; Fields, 1980; Yang, 1999).

In Nigeria, accompany the rapid economic growth that was had between 1965 and 1974 was a serious income disparity believed to have widened substantially (Matlon, 1979; Aigbokhan, 1997; Ipinnaiye, 2001). Despite the past policy interventions to correct this abnormality, the problem of income inequality has increased poverty depth in some urban and rural areas. During the Structural Adjustment Program (SAP), for instance, Aigbokhan (1997, 1999) submitted that a quantitative analysis of the level of income inequality before and after the implementation of the policy shows that income inequality worsened.

2. PROBLEM STATEMENT

High level of income inequality exists in many nations of the Sub-Saharan Africa (SSA). This can be better buttressed by the widening dimension of poverty, and general economic problems in many of these nations. Thirlwall (1994) stated that low income countries contain approximately 62% of the world’s population, and earn only 6% of the world’s income, medium income countries contain 15% of the world’s population and earn 17% of its income, while high income countries contain 25% of the world’s
population and earn 77% of the income. This shows a great disparity between total incomes and per capita income of the developed and developing countries.

In Nigeria, Adelman and Morris (1971) estimated a Gini coefficient of 0.51, showing high level of income inequality. Aboyade (1974), using the 1966/67 household sample survey of 1,635 households, covering wage earners, the self-employed and farmers in the whole country except the eastern region that was going through civil war, estimated the Gini Coefficient to be 0.58. Etukodo (1978) focused on whether income inequality was higher in urban areas than in rural areas. Using data for the Federal Public Service in Lagos and a sample of 400 farming households in Ika village of Cross Rivers State, his results suggested that income inequality was lower in rural Ika than in urban Lagos. More recently, Oyekale (1997), Adejare (1999), Odedele (2000), Ipinnaiye (2001) and Adebayo (2002) have shown that income inequality exists in some rural and urban areas in several parts of Nigeria.

A high level of income inequality exists between Nigerian rural and urban areas. This is because urban dwellers usually earn more than rural dwellers due to their higher literacy level. Higher incomes go to people who have invested time and money to acquire skills (Udo-Aka, 1975). This differential between rural and urban incomes, most times, accounts for the rural–urban migration. Most times, inhabitants of rural areas migrate to the urban areas in search of the proverbial pot of gold or greener pastures because they feel the urban areas hold more opportunities for them than the rural areas. This influx of rural dwellers into the urban areas results in over-population and over-taxing of the amenities available in the urban areas.

Also, most rural communities are agrarian as compared to urban communities (which engage mostly in paid employment), thus they earn less than urban communities. The problem then arises as to how high level of income inequality can be reduced. Inequality in income has many social and economic implications. A high level of income inequality results into discontent among the people, which may result into political unrest and instability. It may also lead to increase in violence, corruption, and attitude of helpless resignation to the caprice of nature and poverty. Thus, it is very pertinent to study income inequality in order to reduce the dimension of poverty.
Income inequality can be detrimental to economic growth and development of a country. As part of macroeconomic objectives, governments always give equitable distribution of income and wealth among the citizens a priority. This emphasizes the importance of income inequality. Addison and Cornia (2001), Adams (1999), Adams and He (1995) and Aboyade (1983) have proved in their various studies that income inequality is closely related to poverty. Thus, a careful study of income inequality also gives insight into the incidence of poverty.

3. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Inequality implies different things to different people. It could be conceptualized as the dispersion of a distribution, whether one is considering income, consumption or some other welfare indicator or attribute of a population. Conceptually distinct as they may be, income inequality is often studied as part of broader analyses covering poverty and welfare. Inequality is a broader concept than poverty in that it is defined over the whole distribution, not only the censored distribution of individuals or households below a certain poverty line (World Bank, 1999; Cowell, 1999).

Inequality can be measured in different ways. Since Atkinson (1970), most questions about the measurement of inequality have been formulated using the explicit logic of social choice theory: desirable properties are articulated and the indices or methods are judged according to how well they conform to the properties. Debates go on about the merits and disadvantages of various subsidiary properties, but there is broad consensus on a core of axioms (Morduch and Sicular, 2002). Dalton (1920) and Pigou (1912) proposed the Pigou-Dalton transfer principle which shows that inequality increases as result of an income transfer from a poorer person to a richer person (Atkinson, 1970, 1983, Cowell, 1985, Sen, 1973). Most measures in the literature, including the Generalized Entropy class, the Atkinson class and the Gini coefficient, satisfy this principle, with the main exception of the logarithmic variance and the variance of logarithms (Cowell, 1995). Dalton (1920) proposed the population principle of income inequality measurement which stated that inequality measures are invariant to replications of the population. This implies that merging two identical distributions will not alter the level of inequality. However, the income scale independence proposition
requires that inequality measures are invariant to uniform proportional changes. This shows that if each individual’s income changes by the same proportion (as it sometimes happens when currency units are changed) then inequality should not change.

Furthermore, *anonymity principle*, sometimes referred to as ‘Symmetry’ - requires that inequality measures are independent of any characteristic of individuals other than their income (or the welfare indicator whose distribution is being measured). The *principle of decomposability* noted that overall inequality is related consistently to constituent parts of the distribution, such as population sub-groups. For example if inequality is seen to rise amongst each sub-group of the population then we would expect inequality overall to also increase.

Some measures, such as the Generalised Entropy class of measures, are easily decomposed and into intuitively appealingly components of within-group inequality and between-group inequality: \( I_{\text{total}} = I_{\text{within}} + I_{\text{between}} \). Other measures, such as the Atkinson set of inequality measures, can be decomposed but the two components of within- and between-group inequality do not sum to total inequality. The Gini coefficient is only decomposable if the partitions are non-overlapping, that is the sub-groups of the population do not overlap in the vector of incomes.

Kuznets (1955), based on long run time series data for three developed countries (U.S., England, Germany) hypothesized a time path of inequality for nations undergoing economic development with an increase in inequality in the early stages, followed by a decrease in later stages. This has come to be known as the Kuznet U-shaped curve hypothesis on relationship between inequality and development.

Kuznet (1963) observed that average income from non-agricultural sectors were higher than those from agricultural activities and were associated with differences in organization, technology and productivity. Intra-sectorally, income inequality was lower within the agricultural than within the non-agricultural sector for most countries, although the agricultural sector’s inequality was still higher for the under-developed than the developed countries. He also observed that the degrees of income inequality seemed to worsen with development, because of the rising relative importance of non-agricultural activities. Milanovic (1998) noted that almost all socialist countries had low degrees of
income inequality before their transition from planned economy to market economy. Income inequality in socialist countries derives mainly from inequality in wages and not from ownership of capital, which is largely in public hands.

Adam and He (1995) recently noted that the work of Kuznets (1955, 1963) on the relationship that exists between development and income inequality has given further inspirations to researchers in the drive towards accurately discovering the major component sources of income inequality. A micro-survey of some households in Ibadan by Oyekale (1997) revealed that Gini-coefficient was 0.3716, while Adejare (1999) estimated 0.57. World Bank (2003) shows that in 1996/97, Gini index for Nigeria was 0.506, while Ghana and Cameroon have 0.407 and 0.477 respectively. Using 1998 data, World Bank (2003) also estimated Gini-indices of 0.613 and 0.526 for Central African Republic and Zambia respectively. In rural Tanzania, Ferreira (1996) found that during the period of structural adjustment, there was a reduction in poverty but income inequality increased between 1983 and 1991. From all these studies, it can be deduced that income inequality is high in many African nations, especially Nigeria.

Decomposition of income inequality is desirable for both arithmetic and analytic reasons (World Bank, 1999). Economists and policy analysts may wish to assess the contribution to overall inequality within and between different sub-groups of the population, for example within and between workers in agricultural and industrial sectors, or urban and rural sectors. Decompositions of inequality measures can shed light on both its structure and dynamics. Inequality decomposition is a standard technique for examining the contribution to inequality of particular characteristics and can be used to assess income recipient characteristics and income package influences. These analyses were pioneered by Bourguignon (1979), Cowell (1980), and Shorrocks (1982a; 1984).

Ipinnaiye (2001) found that decomposition analysis of income shows that non-farm income contributes the most to overall income inequality in both the peri-urban and urban areas of Ibadan. Also, income inequality was higher in peri-urban areas than urban areas in 2000. Adebayo (2002) found that in the rural areas in Ibadan metropolis, agricultural income contributes most to the overall income inequality accounting for 91% while rental income makes the least contribution to overall rural income inequality accounting for just 0.17%. In the urban areas, non-farm income makes the largest
contribution to overall income inequality accounting for 88% while transfer income reduces urban overall income inequality by 0.13%.

Piesse et al (1998) used a Gini decomposition to analyse the effects of crop, animal and non-farm income on the distribution of total income in the communal lands in Zimbabwe. Results show that non-farm income decreases inequality in Chiweshe, which is near Harare. Particularly, a substantial part of reduction in equality arises from greater non-farm incomes at the bottom of the scale, so poverty is reduced by access to alternative income sources. However, in the more remote and traditional region of Gokwe, non-farm income increases inequality, accruing particularly to the relatively well off rather than the poor. Thus, it was concluded that the opportunities offered by the development of markets and non-farm opportunities appear to be important to poverty reduction.

Adams (1999) used household-level data from a nationally representative survey to analyze the impact of nonfarm income on income inequality in rural Egypt. The decomposition was done using total rural income among five sources of income, which were nonfarm, agricultural, livestock, rental and transfer. The analysis shows that while nonfarm income represents the most important inequality-decreasing source of income, agricultural income represents the most important inequality-increasing source of income.

Jacobs (2000) found that in Japan, Taiwan and South Korea, total income inequality accounted for by differences between age groups is very low (less or equal to 5%). Inequality was much more prevalent between individuals of the same age category than between the means of different age groups. In other words, age does not explain much of the observed income inequality in any of the three countries.

Bouillon et al (2001) used a simulation empirical framework to identify the contribution of microeconomic factors to increasing income inequality in Mexico in 1984 and 1994. Having specified different regression equations for the determinants of per capita income in 1984 and 1994, they proceeded to simulate the impact of changes in observable and unobservable characteristics. The micro-simulation method decomposes the observed changes in the distribution of income into “return effect”, “population effect” and the “effect of unobservables”. Results showed that changes in returns to household characteristics, in particular changes to education are responsible for about 50
percent increase in Gini-coefficients. The deteriorating conditions in rural areas relative to the urban areas and of the southern region relative to other regions account for another 25 percent increase in the Gini.

Morduch and Sicular (2002) introduced a new integrated regression-based approach for decomposing inequality indices with household-level data, and examined the strengths and weaknesses of inequality decompositions by income source in light of the way that they are commonly interpreted. The approach uses estimated income flows from variables in linear income equations to decompose aggregate inequality indices. The integrated approach provides an efficient and flexible way to quantify the roles of variables like education, age, infrastructure, and social status in a multivariate context. These tools are applied to a new data set with rich information on incomes in Zouping County in Shandong Province, China. The evidence from China illustrates the sharp differences that can result when using decomposition methods with varying properties, and it demonstrates advantages of the proposed, integrated method. The empirical results show the importance that spatial segmentations play in increasing inequality: village of residence strongly drives inequality in the sample. This force is counter-balanced in part by the relatively equitable distribution of human capital, especially demographic variables. Contrary to other recent findings, affiliation with the Communist Party and measures of social status have a very limited role in explaining inequality.

Alayande (2003) decomposed income inequality and poverty in Nigeria with the regression-based decomposition approach developed by Morduch and Sicular (2002) using the 1996 data collected by the Federal Office of Statistics (FOS). The results showed that primary and post-secondary educational attainments are important in reducing income inequality in Nigeria, while the number of unemployed in the households contributed positively to income inequality.

Elbers et al (2003) estimated income inequality for Ecuador, Mozambique and Madagascar. Based on a statistical procedure that combines household survey data with population census data, their analyses showed that the share of within-community inequality in overall inequality is high. Specifically, computed Gini-coefficients were between 0.320 – 0.518 and 0.320 – 0.440 in Madagascar and Mozambique respectively.
4. JUSTIFICATION FOR THE STUDY

Several studies in Nigeria have decomposed income inequality by economic sector (urban versus rural), income source (income from labour versus income from capital versus land) and family characteristics (including educational and occupational attributes of workers). Most of these studies were conducted at the Local Government level, and the studies are useful because they help to identify the structure of income inequality within a given society. However, their application for policy formulation at the national level is limited due to small scope. This study seeks to use the most current national data, and will add to the already existing body of knowledge by decomposing the sources of income inequality using five income sources. The knowledge of the various sources of income inequality will help policy makers to formulate policies that will ensure reduction in the level of income inequality in the country. Knowing the sources of incomes that increase overall income inequality will also make it possible for developmental efforts to be concentrated on income sources that reduce income inequality to enhance the welfare of the least privileged in every community in the nation. The knowledge of the sources of income inequality will therefore help in reducing poverty, because several studies have established the fact that poverty is invariably related to income inequality. Also the study attempts to go a step further by using the regression-based decomposition of income inequality recently developed to decompose inequality in welfare based on the socio-economic characteristics of the households. This implies that the findings of the study will not only focus on the occupational groupings of the households for policy implementation, but will equally address the effect of some socio-economic factors. This, no doubt will assist Nigerian policy makers to select the best option for ensuring rapid economic growth and development amidst diverse competing options.

5. OBJECTIVES OF THE STUDY

The general objective of the study is to determine the sources of income inequality among some rural and urban households in Nigeria. The specific objectives are:
i. To determine the level of income inequality in the rural and urban areas;

ii. To determine the contribution of each income source to overall income inequality; and

iii. To decompose income inequality based on some socio-economic characteristics of the rural and urban households.

iv. To determine the effect of some socio-economic characteristics of households on per capita income (measure of welfare).

6. RESEARCH HYPOTHESES

The following null hypotheses will be tested for acceptance or rejection in the study:

Ho1: There is no significant difference between the income received from different sources in the urban and rural areas.

Ho2: None of the socio-economic characteristics has significant influence on the per capita income of the households in the rural and urban areas.

Ho3: There is no significant difference between inequality in welfare and socio-economic classes of households in the rural and urban areas.

7. METHODOLOGY

Sampling Procedures

The data for the study will be collected from the Federal Office of Statistics (FOS). The data are based on National Integrated Survey of Households (NISH) that was carried out in all the states of the nation in 2003. The sample design that was used is two stage stratified sampling with the 1st stage involving clusters of housing units called Enumeration Area (EA), and the 2nd stage involves the housing unit. The sample size is determined from 120 EAs selected in each of the 36 states of the nation and Abuja which is the Federal Capital Territory (FCT). Out of these, 5 housing units were selected randomly from each of the EAs. A total of 600 households will be randomly chosen in each of the states, implying that 22,200 households were selected in all (FOS, 2003). However, the data to be used in this study will be drawn from 6 of the states to be randomly selected from the 6 geo-political zones in Nigeria- 1 states per zone. The zones
are south-south, south west, south east, north central, north east and north-west. This shows that the number of respondents to be included in this analysis will be 3,600.

The concept of income used in the study reckons with income earned both in cash and in kind. Therefore, money values were allocated to receipts of income in kind and household consumption of crops and livestock produced based on prevailing market prices. Values were also computed for houses occupied by their owners. Recognition was made of whether incomes recorded were incomes before or after taxation. Following Adams and He (1995), the study identified the following sources of income:

- Non-farm income: includes income realized from non-farm labours, government and private sector employment (full or part time), and profits from non-farm enterprises.
- Agricultural income: includes net income from all crop production with imputed values from home production and agricultural labours.
- Transfer income: includes income from relatives within and outside the country, government pension and other gifts received.
- Livestock income: includes net income from cattle, poultry, sheep, goat and pigs etc.
- Rental income: includes net income received from ownership of assets.

**Measurement of Income Inequality**

In order to achieve objective 1, the following descriptive statistics will be used to analyze the pattern of income distribution: the standard deviation, kurtosis, skewness, coefficient of variation, and the mean. Income inequality will be measured using the Gini-Coefficient. Following Morduch and Sicular (2002), where incomes are ordered so that $Y_1 \leq Y_2 \leq Y_3 \leq \ldots \leq Y_n$ Gini-coefficient is computed as

$$I_{\text{gini}}(Y) = \frac{2}{n^2 \mu} \sum_{i=1}^{n} \left( i - n + 1 \right) Y_i$$

Where $n$ is the number of observation, $\mu$ is the mean of the distribution, $Y_i$ is the income of $i$th household. This measure of income inequality conforms with the Pigou-Dalton transfer principle, income scale independence, principle of population, and anonymity or
symmetry but fails the decomposability axiom if the sub-vectors of income overlap. However, several authors have shown that Gini-coefficient can be decomposed successfully.

**Decomposition Based on Coefficient of Variation**

In order to fulfill objective two, the sources of income inequality would be decomposed based on the coefficient of variation and Gini Coefficient. Although the two approaches give similar results, we are specifically interested in knowing what the outcomes would be for this data set. Following Shorrocks (1982b) suppose total income \((Y)\) consists of income from \(k\) sources. The variances of each of the sources of income, \(\sigma^2\), and the covariances between sources of income \(\sigma_{ij}^2\) can be expressed as equal to variance of total income.

\[
\sigma^2 = \sum \sigma_i^2 + \sum \sigma_{ij} \tag{2}
\]

The contribution of the \(i\)th source of income to households’ total income variance comprises of the \(j\)th income variance and part of the covariances allocated to the \(i\)th source. Also, the natural decomposition of the variances assigned to the \(i\)th source exactly one-half of all covariances involving the \(i\)th source of income. This can be expressed as:

\[
\sigma^2 = \sum \sigma_{iy} \tag{3}
\]

Furthermore, the decomposition corresponding to the coefficient of variation can be further expressed as:

\[
\sum w_i c_i = 1; \tag{4}
\]

\[
w_i = \mu_i / \mu; \tag{5}
\]

\[
c_i = \rho \frac{\sigma_i / \mu_i}{\sigma / \mu} \tag{6}
\]

where: \(w_i c_i\) = factor inequality weight of the \(i\)th source in overall inequality

\(
\mu_i = \text{mean of income from } i\text{th source} \)

\(
\mu = \text{mean of total income from all sources} \)

\(
c_i = \text{relative concentration coefficient of } i\text{th source in overall inequality} \)

\(
\rho = \text{correlation coefficient between the } i\text{th source and total income} \)
**Decomposition Based On Gini-Coefficient**

Following Pyatt *et al* (1980), the Gini-coefficient can be decomposed as follows:

\[ G = \frac{2 \text{ Cov} (Y, r)}{n\mu} \] ..............................7

where \( n \) is the number of observations, \( Y \) is the series of total income and \( r \) is the series of corresponding ranks.

The Gini coefficient of the \( ith \) source of income, \( G_i \) can be expressed as

\[ G_i = \frac{2 \text{ Cov} (Y_i, r_i)}{n\mu} \] ..............................8

where \( Y_i \) and \( r_i \) refer to the series of income from the \( ith \) source and corresponding ranks respectively. Since total income is the sum of source incomes, the covariance between the total income and its rank can be written as the sum of covariances between each source income and rank of total income. The total income Gini can then be expressed as a function of the source Ginis.

\[ G = \sum \frac{\mu_i}{\mu} = R_i G_i \] ..............................9

Where \( R_i \) is the correlation ratio expressed as:

\[ R_i = \frac{\text{ Cov} (Y, r)}{\text{ Cov} (Y_i, r_i)} \] ..............................10

where \( \text{ Cov} (Y, r) \) is the covariance of total income and corresponding rank respectively and \( \text{ Cov} (Y_i, r_i) \) the covariance of the \( ith \) source of income and corresponding rank.

The decomposition of Gini coefficient can be further expressed as:

\[ \sum w_i g_i = 1 \] ..............................11

\[ w_i = \frac{\mu_i}{\mu} \] ..............................12

\[ g_i = R_i \frac{G_i}{G} \] ..............................13

Where \( w_i g_i \) is the factor income inequality weight of the \( ith \) source in overall income inequality, \( w_i \) is the source income weight and \( g_i \) is the relative concentration
coefficient of the $i$th source in overall inequality. An income source increases overall income inequality when $g_i$ is greater than one and it decrease overall income inequality when $g_i$ is less than one.

**Regression-Based Decomposition**

In order to fulfill objective three and four, the regression based decomposition approach developed by Morduch and Sicular (2002) will be used. The decomposition is done as follows:
Suppose an income equation is defined as:

$$Y = X\beta + \epsilon$$

Where $Y$ is the per capita income (N) and $X$ is an $n \times M$ matrix of independent variables with the first column given by the $n$-vector $e = (1,1,\ldots,1)$,

More specifically, we propose the following variable specifications:

- $X_1 =$ age of house head
- $X_2 =$ age of house head square
- $X_3 =$ Year of education of house head
- $X_4 =$ Number of household members with primary education
- $X_5 =$ Number of household members with secondary education
- $X_6 =$ Number of household members with tertiary education
- $X_7 =$ Household dependency ratio
- $X_8 =$ Land owned (ha)
- $X_9 =$ Migrant status Dummy (migrants = 1; 0 otherwise)
- $X_{10} =$ Total number of hours household members worked per week
- $X_{11} =$ Crop diversification index measured by the Herfindal Index which is

$$\sum_{i=1}^{n} \left( \frac{C_i}{\sum_{i=1}^{n} C_i} \right)^2 \times 100 \text{ with } C_i \text{ being the area of land planted to } ith \text{ crop.}$$

- $X_{12} =$ Government job dummy (1 for government employment, 0 otherwise)
- $X_{13} =$ Farming job dummy (1 for farmers, 0 otherwise)
- $X_{14} =$ Trading job dummy (1 for traders, 0 otherwise).
- $X_{15} =$ Location dummy (urban 1, 0 otherwise)
$X_{16}$ = Number of people unemployed in the family
$X_{17}$ = Amount of credit obtained (N)
$X_{18}$ = Secondary occupation dummy (1 for Yes, 0 otherwise)

$\beta$ is an $M$-vector of regression coefficients, and $\varepsilon$ is an $n$-vector of residuals. The $M$ coefficients can be estimated using appropriate econometric techniques with specification corrections as required. Predictions of per capita income $\hat{Y} = X\hat{\beta}$ are formed using information from the entire data set. However, a major limitation is that the influence of a variable that is constant for all the observations cannot be estimated.

Since the econometric results yield estimates of the income flows attributed to household variables, they allow us to decompose inequality by factor income- that is to apportion inequality to the components of income, where the sum of these components equals total income, $Y_i = \sum_{k=1}^{k} Y_i^k$. In this case, the analogues are the $\hat{Y}^m = X\hat{\beta}^m$, the income contributed by the socio-economic variables as given in the estimated regression equation (plus the regression residual):

$$Y_i = \sum_{M=1}^{M} \hat{Y}_i^M \text{ for all } i,$$

$$\hat{Y}^m = \hat{\beta}_{m} X_i^m \text{ for } m = 1, \ldots, M$$

$$\hat{Y}_i^m = \hat{\varepsilon}_i \text{ for } m = M+1$$

The income flow will then be used to directly calculate decomposition components for all regression variables. The shares take the form:

$$s(X^m, Y) = \hat{\beta} \left( \frac{\sum_{i=1}^{n} \hat{a}_i(Y) X_i^m}{I(Y)} \right) \text{ for } m = 1, \ldots, M$$

The standard errors can be computed since the decomposition in equation 15 is linear in the estimated parameters. The standard error (.) can therefore be obtained from
\[ (s(X^m, Y)) = (\beta) \left( \sum_{i=1}^{n} \frac{a_i(Y)X_i^m}{I(Y)} \right) \]  

Under the assumption of homoscedastic error, \( \bar{\varepsilon} = \bar{\varepsilon} \) for all \( i \), and

\[ (s(\varepsilon, Y)) = \left( \frac{1}{2n} \sum_{i=1}^{n} \left( \frac{d(Y)}{I(Y)} \right)^2 \right)^{1/2} \]

The standard error provides confidence intervals for the estimated contributions to mean values of the aggregate inequality indices, analogous to the interpretation of standard errors in OLS regression analysis.

For application, inequality indices that can be written as a weighted sum of incomes was then considered.

\[ I(Y) = \sum_{i=1}^{n} a_i(Y)Y_i \]

Many common indices can be written in this way and they include the variance and squared coefficient of variation, the Theil indices and the Gini-coefficient. The proportional contribution of source \( k \) to overall inequality is simply expressed as:

\[ s(Y^k, Y) = \frac{\sum_{i=1}^{n} a_i(Y)Y_i^k}{I(Y)} \]

and the sum of the \( k \) proportional contributions will equal one by construction. Given the condition for deriving equation 1, the Gini decomposition can be decomposed as the proportional share of inequality for source \( k \) and expressed as:

\[ S_{Gini}(Y^k) = \frac{\sum_{i=1}^{n} \left( i - \frac{n+1}{2} \right)Y_i^k}{\sum_{i=1}^{n} \left( i - \frac{n+1}{2} \right)Y_i} \]

With respect to coefficient of variation, the decomposition is stated as:

\[ I_{cv}(Y) = I_{var}(Y)\mu^2 = \frac{1}{n\mu^2} \sum_{i=1}^{n} (Y_i - \mu)Y_i = \frac{\text{var}(Y)}{\mu^2} \]
Finally, for Theil indices, the property is not violated. The decomposition is stated as follows for Theil-T index:

\[ I_{TT}(Y) = \frac{1}{n} \sum_{i=1}^{n} \frac{Y_i}{\mu} \ln \left( \frac{Y_i}{\mu} \right), \quad S_{TT}(Y^k) = \frac{\sum_{i=1}^{n} Y_i^k \ln \left( \frac{Y_i}{\mu} \right)}{\sum_{i=1}^{n} Y_i \ln \left( \frac{Y_i}{\mu} \right)} \]

\[ I_{TL}(Y) = \frac{1}{n} \sum_{i=1}^{n} \frac{Y_i^k}{Y_i} \ln \left( \frac{\mu}{Y_i} \right), \quad S_{TL}(Y^k) = \frac{\sum_{i=1}^{n} Y_i^k \ln \left( \frac{\mu}{Y_i} \right)}{\sum_{i=1}^{n} Y_i \ln \left( \frac{\mu}{Y_i} \right)} \]

8. EXPECTED OUTPUT AND DISSEMINATION

The findings of this study will go a long way in addressing the protracted poverty problem in Nigeria. This is because identification of income source that is inequality increasing will assist in formulating the right policies to address it. Policy makers will therefore find the study very relevant for drawing policy issues in line with the challenges of ensuring improved living condition for all Nigerians in this democratic dispensation. The findings will be included as part of the Policy Briefs to be submitted to the Federal Government of Nigeria as research findings and inputs from our Department to national economic growth and development. Findings of the study will also be discussed in related conferences and seminars both at the national and international levels. The study will add to existing literature on the issue of income distribution in Nigeria and the papers to be published there from will serve as basis for promoting the researchers and quick references for students being taught by us and others in related fields. Books and other materials acquired through the study used will help the researcher in teaching and in conducting further research on issues related to Welfare Economics.
9. PRIOR TRAINING AND EXPERIENCE OF RESEARCHERS

Mr. Oyekale (Team Leader)

I am one of the academic staff in the Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria. I obtained B. Sc. (First Class Hons.) and M. Sc. Degrees in Agricultural Economics from the University of Ibadan in 1994 and 1997 respectively. I have been lecturing since September 2000 and my PhD program simultaneously commenced in 2000/2001 session. I have been involved in teaching courses like Econometrics, Principles of Macro Economics, Agribusiness Management, Statistics and Research Methods and Introduction to Computer in Agriculture at the undergraduate level. I have completed the supervision of 14 B. Sc. students on different topics like child labour, deforestation, HIV and agricultural production, income inequality, poverty, land use and agricultural intensification, inflation and agricultural growth, consumer analysis, marketing of agricultural produce etc. Currently, I am supervising 7 undergraduate students in our Department. My PhD program for which I got a grant award from the African Economic Research Consortium, Nairobi, Kenya, has significantly advanced from the post data seminar to registration of thesis’ title. The oral examination has been scheduled for mid-March 2004. Since my appointment in 2000, I have published 15 of my research papers in reputable Journal in Nigeria and outside the country. It is equally worthy to note that I have written and published a text book on “Introduction to Computer in Agriculture”.

Moreover, I participated in the field surveys of a study commissioned by the World Bank on “Institution Strengthening for the Second Phase of Fadama Project” commissioned to BDO – OFO in 2001. Also, I was involved in another study on “Developing Indicators for Accessing the Performance of Fadama Project” by the Department of Agricultural Economics in 2001/2002. I am currently part of the 7-men team handling a study on “Waste to Wealth Project” of the University of Ibadan. I have also attended conferences and workshops in Nigeria. However, many of my papers have been accepted for international conferences, and in 2003, I got a Rockefeller Foundation Grant to attend the International Association of Agricultural Economists conference that was held in South Africa. With these experiences (and those of my colleague team...
members), I have no doubt that we are competent to successfully conduct this study if sponsored by PEP.

REFERENCES


WORK PLAN

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time scheduled</th>
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<tr>
<td>Literature search</td>
<td>2 month</td>
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<tr>
<td>Data collection</td>
<td>3 months</td>
</tr>
<tr>
<td>Data analysis</td>
<td>2 month</td>
</tr>
<tr>
<td>Writing of draft report</td>
<td>3 months</td>
</tr>
<tr>
<td>Correction and writing of final report</td>
<td>2 months</td>
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Total 12 months

RESEARCH BUDGET

<table>
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<tr>
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<tr>
<td>Data collection expenses</td>
<td>2500</td>
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<td>Salary for 1 research assistant @ $250 per month for 12 months</td>
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<td>Research related transportation expenses</td>
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<td>Postage and telecommunication</td>
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<tr>
<td>Computer set and software for data analysis</td>
<td>3000</td>
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<tr>
<td>Stationary and miscellaneous expenses</td>
<td>1500</td>
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<td>Journals and books</td>
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</table>

Total cost 14500

Researchers’ institutions contribution to salary during the period of research $10,000
CURRICULUM VITAE

Full Name: Abayomi Samuel Oyekale
Nationality: Nigerian
State of Origin: Osun
Home Town: Ipetumodu
Sex: Male
Marital Status: Married
Date of Birth: 9th December 1969
Postal Address: Dept of Agricultural Economics, University of Ibadan, Ibadan, Nigeria.
Contact Address: Dept. of Agricultural Economics, University of Ibadan, Ibadan, Nigeria.
E-Mail Addresses: asoyekale@yahoo.com

ACADEMIC QUALIFICATIONS:

<table>
<thead>
<tr>
<th>Date</th>
<th>Institution/College</th>
<th>Qualification/Result</th>
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<tbody>
<tr>
<td>1995-1997</td>
<td>University of Ibadan, Ibadan,</td>
<td>M.Sc. Agric. Econ. (GPA 69.9%)</td>
</tr>
<tr>
<td>1988-1994</td>
<td>University of Ibadan, Ibadan,</td>
<td>B.Sc. Agric. Econ. (First Class Honours)</td>
</tr>
<tr>
<td>1995</td>
<td>Centre for Research and Development, Ondo State University, Ado-Ekiti.</td>
<td>Cert. in Computer: Ms-Dos, WP, Dbase, Lotus 123, Word, and Excel</td>
</tr>
<tr>
<td>1981-1987</td>
<td>Origbo Community High Sch., Ipetumodu, Osun State.</td>
<td>8 O-Level Credits With English and Mathematics</td>
</tr>
</tbody>
</table>

EMPLOYMENT HISTORY

1. Employer: Center for Research and Development, (OSUA)
   Position: Asst Senior Accountant
   Duration: May 1994 and April 1995
   Responsibilities: Preparation of Journal and payment vouchers, posting of different accounts into cashbook, preparation of the over-all account at the end of year, preparation of the monthly pay roll and auditing of the company’s stock register.
2. **Employer:** B-Y Consults, ANCE Building, Jericho, Ibadan  
   **Position:** Research Assistant  
   **Duration:** Jan. 1999 to July  
   **Responsibilities:** Research Survey, Data Collation, Data Analysis, Report writing and research paper writing, literature search, office administration.

3. **Employer:** Cocoa Research Institute of Nigeria (CRIN)  
   **Position:** Research Officer I  
   **Duration:** August - October 2000.  
   **Responsibilities:** Research survey, data collation, data analysis, report writing, research paper writing, paper presentation, literature search, office administration.

4. **Employer:** University of Ibadan, Ibadan.  
   **Position:** Assistant Lecturer  
   **Duration:** November 2000 to date.  
   **Responsibilities:**  
   - 2000/2001 Session: Taught Agribusiness Management (AGE 513) and Principles of Macroeconomics (AGE 521). Supervised 7 undergraduate students on various project topics. Member of Undergraduate committee.
   - 2001/2002 Session: Taught Statistics and Research Methods (AGE 511), Principles of Macroeconomics (AGE 521) and Computer in Agriculture (AGE 201). Supervised 7 undergraduate students on various project topics. Member of Undergraduate committee.
   - 2002/2003 Session: Teaching Computer in Agriculture (AGE 201), Econometrics (AGE 516) and Natural Resource Economics (APA 716). Supervising 7 undergraduate students.

**DEGREE PROJECT WORKS**


PUBLICATIONS
Books or chapters in books already published


(ii) Paper Published in Learned Journals


(iii) **Books, Chapters in books and articles already accepted for publication**


**ACADEMIC AWARDS AND GRANTS**

<table>
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<tr>
<th>Description of Awards</th>
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<tr>
<td>1. University of Ibadan Postgraduate Scholarship Award</td>
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<td>2. Zard Scholarship for Agriculture, University of Ibadan. 1995/96 session</td>
<td>1997</td>
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<td>5. NUPEMECO Prize for Agriculture</td>
<td>1994</td>
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<td>6. Sir Kofo Abayomi Prize for Agriculture</td>
<td>1994</td>
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<tr>
<td>7. Rockefeller Grant to Assist Attendance at 25th IAAE</td>
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</table>
Conference to be held at Durban, 17th – 22nd August, 2003.  

PhD Dissertation Grant awarded by African Economic Research Consortium (AERC)  

**CONFERENCES PAPERS PRESENTED AND/OR ACCEPTED FOR PRESENTATION**


- 25th Conference of the International Association of Agricultural Economists, Durban South Africa. Poster Paper on “Effect of Agricultural Intensification on Food Crop Production in Southwest and Southeast Nigeria” accepted for presentation. **August 2003**

- International Conference on Local Land use in A Globalizing World: Shaping Sustainable Social and Natural Environments, Denmark. Poster Paper on “Continuous Cropping and Efficiency of Food Production in Delta State, Nigeria” accepted for presentation. **August 2003**

- 1st World Conference on Agroforestry, Florida, USA. Oral paper presentation on “Land Management and Food Production Efficiency in the Rainforest Belt of Nigeria” accepted for presentation. **June 2004**


**HOBBY**

Reading, friend making and music

**REFEREES**

<table>
<thead>
<tr>
<th>Prof. J.A. Akinwumi, Department of Agricultural Economics. University of Ibadan, Ibadan.</th>
<th>Prof. A.O. Falusi, Department of Agricultural Economics. University of Ibadan, Ibadan.</th>
<th>Dr.J.O. Akintola (JP) Department of Agricultural Economics. University of Ibadan, Ibadan.</th>
</tr>
</thead>
</table>

I hereby certify that information provided here are correct to the best of my knowledge.  

**A.S. Oyekale**  
CURRICULUM VITAE

I. PERSONAL DATA

Name: ADEOTI, Adetola Ibidunni

Nationality: Nigerian

Date of Birth: 15th August, 1962

Department: Agricultural Economics

II. Date of Present:

Appointment: Lecturer II (15th December, 2001)

Date Last Put Up For Promotion: 2001

III. University Education

University of Ife, Ile-Ife 1980-1985
University of Ibadan, Ibadan 1986-1987

IV. Academic Qualifications and Diplomas

B. Agric (Agricultural Economics) 1985
M.Sc. (Agricultural Economics) 1987
Ph.D (Agricultural Economics) 2001
Ordinary Diploma (Computer Techniques and Application) 1996

V. Professional Qualifications and Diplomas

Nil

VI. Membership of Society

Member, Nigerian Society of Agricultural Economists
Member, Nigeria Participatory Rural Appraisal Network (NIPRANET)

VII. Details of Teaching Experience at the University Level

<table>
<thead>
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<th>Course No</th>
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<tr>
<td>AGE 201</td>
<td>Introduction to Computer in Agriculture</td>
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<td>1997 till 2001</td>
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<tr>
<td>AGE 300</td>
<td>Computers in Agriculture</td>
<td>3</td>
<td>1998 till date</td>
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Other Departmental/Faculty Responsibilities

(1) Departmental Representative to the Faculty Library Committee 1997/98 Session
(2) Member of Department’s Undergraduate Committee 1999/2000 Session till date

Supervision of Students

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<th>Completed</th>
<th>In Progress</th>
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<tr>
<td>B.Sc.</td>
<td>10</td>
<td>5</td>
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29
VIII. Research Completed
(2) Fertilizer Distribution and Supply to Farmers in Oyo State.

Research In Progress
(1) Economic Analysis of Irrigated and Rainfed Production Systems in Kwara State, Nigeria.
(2) Determinants of Foreign Direct Investment in Agriculture.
(3) Gender Issues in Poverty Reduction in Agriculture.

Dissertation and Thesis

IX. Publications
Books or Chapter in Books already published.
Nil

Articles Accepted For Publication.

X. Conference Attended with Paper Read
CURRICULUM VITAE

PERSONAL DATA

Name: Tolulope Olayemi OGUNNUPE
Sex: Female
Date of Birth: 20th November 1971
Place of Birth: Ijebu Ode
State of Origin: Ogun
Nationality: Nigerian
Marital Status: Single
Contact/ Postal Address: C/O Mr. A. S. Oyekale, Department of Agricultural Economics, University of Ibadan, Ibadan. Tel: 08037194863
E-Mail Address: olayemitolulope@yahoo.com

INSTITUTIONS ATTENDED WITH DATE

University of Agriculture, Abeokuta, Ogun State 1994-2000
University of Ibadan, Ibadan. 2002-2003

ACADEMIC QUALIFICATIONS

West African School Certificate (WASC) 1994
B.Agric. (Agricultural Economics and Farm Mgt.) 2000
M.Sc. (Agricultural Economics) 2003

WORK EXPERIENCE

(i). Clerical Officer (Ijebu Ode Local Government Education Authority)
Job Description: Library book cataloguing, sorting and management.
January 1992- January 1993

(ii). Teacher: (Community Secondary School, Ugwogo-Nike - NYSC)
Job Description: Taught Agricultural Science in JS2, SS1, and SS2 and supervision of students. Directly responsible to the principal and vice principals for administrative assignments that concerned the school.
July 2000 – July 2001

(iii). Teacher: (Nickdel College International, Akobo, Ibadan)
Job Description: Teaching Agricultural Science in JS1, JS2, JS3, SS1, and Social Studies in JS1. Class teacher to SS1 and SS2. Member of school loan administration committee and school prefect monitoring committee. Responsible directly to the Proprietor, Principal, and Head of Department for other administrative assignments. 

March 2003 – Date.

RESEARCH PROJECTS


PUBLICATION


**Paper Submitted For Publication In Learned Journal**

Oyekale, A.S. T.T. Awoyemi and **T.O. Ogunnupe** (under review): Agricultural Intensification and Efficiency of Food Production in the Rainforest Belt of Nigeria. Paper submitted for special issue on “Sustainable Agricultural Intensification” by the *Agricultural Economics*.

**ACADEMIC AWARD:**

Best female farmer of the year (UNAAB) 1999

**HOBBY:** Singing and sporting

**REFEREES:**

<table>
<thead>
<tr>
<th>Prof. A.O. Falusi,</th>
<th>Dr. J.O Akintola,</th>
<th>Dr. S.A.Yusuf,</th>
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<tbody>
<tr>
<td>Dept. of Agric Econ.</td>
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