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Evolution of Inequality in Nigeria: a Tale of Falling Inequality, Rising Poverty, and Regional Heterogeneity

John Chiwuzulum Odozi¹ · Ruth Uwaifo Oyelere^{2,3}

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Abstract

Recent research on Nigeria indicates declining income inequality. In contrast, anecdotal evidence suggests that only the upper class has benefited from economic growth in Nigeria over time. The disconnect between these findings and anecdotal evidence, and the limitation in how inequality was estimated in the past literature are the motivation for our research. First, we consider if inequality decreased in Nigeria between 2010 and 2018. We then examine how changes in inequality relate to changes in consumption and poverty. In addition, we examine whether there has been convergence in inequality and consumption across geopolitical regions over this period? Leveraging data from the four waves of the Nigeria General Household Panel Survey (GHS) and carefully measuring inequality in consumption expenditure using Gini, our results suggest that between 2010 and 2018, inequality decreased and median consumption expenditure increased. At the same time, poverty incidence and severity increased precipitously. Our findings also suggest convergence across regions over time in estimated within region Gini. In contrast, we find evidence of divergence across regions over time in median households' consumption.

Keywords Inequality · Gini · Nigeria · Income distribution · Poverty · Regional disparities

Introduction

Nigeria is a country of significant contrasts. It is the largest economy in Africa but was also ranked highest among 152 countries in inequality in 2017 using Oxfam Inequality Index. While recent research suggest a decline in inequality and poverty, anecdotal evidence points to falling living standards and significant heterogeneity in welfare across geopolitical regions. These seeming contradictions call for a more careful examination of the evolution of economic inequality.

In this paper, we focus on two main questions. First, has inequality decreased between 2010 and 2018 in Nigeria and what consumption sources are driving this change? We also

examine if the change in inequality mirrors changes in consumption and poverty over time. Second, is there evidence of convergence across geopolitical regions in measured within region inequality and consumption levels? We also examine if differences across regions in consumption contribute more to national inequality than differences within regions. It is important to explore inequality not only at the national level but within geopolitical regions because of the important role regions play in Nigeria. Regions/zones in Nigeria are not entirely based on geographic location but are also linked with political, ethnic, and cultural history. More importantly, these regions form the basis of the distribution of resources among Nigerians whether educational, political, and economic. To address our questions of interest, we make use of the four waves of the General Household Survey (GHS) of Nigeria.

Inequality can be examined using multiple measures each with strengths and weaknesses. In this paper, we focus on vertical inequality and measure it using the Gini coefficient estimated on consumption expenditure (Gini (1936)).¹ Our results suggest that inequality in consumption decreased by 3.98% between 2010 and 2018. In contrast, poverty inci-

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¹ For the purpose of this paper, when we refer to inequality, we mean inequality in consumption expenditure across individuals.

dence increased by 22 percentage points. The rise in poverty is surprising given the 6% increase in real median consumption expenditure per adult equivalence over this period. In addition, while our results suggest that within region estimates of inequality (Gini) are converging over time, median consumption expenditure estimates by region are diverging. Furthermore, our results suggest that consumption inequality across regions contribute significantly more to the national inequality estimate than within region differences. We also find that inequality in the flow from durable goods consumption across individuals is the highest contributor to our estimate of vertical inequality.

Our paper contributes to the literature by providing careful estimates of consumption inequality and its evolution in Nigeria from 2010 to 2018. Given the significant position of Nigeria in Africa, having reliable recent estimates of vertical inequality over time, that are comparable, is valuable and has the potential to drive policy changes. In addition, our results provide a cautionary tale as to why solely examining inequality or changes in consumption as a way to gauge economic progress and development could be misleading.

The rest of our paper is as follows. In Section 2, we highlight briefly the past literature focused on inequality in Nigeria. In Section 3, we discuss our data and methodology. Our results are summarized in Section 4. We conclude in the final section.

Literature Review: Inequality in Nigeria

Inequality can be considered using different measures and can be measured vertically between individuals and also horizontally across groups. Inequality is also multidimensional and disparities across regions in Nigeria have been suggested by most of the past literature.² Deriving estimates of income inequality in Nigeria began over 4 decades ago. Early papers provided estimates of inequality solely for regions in Nigeria. For example, Teriba and Philips (1971), estimated the Gini coefficient using the 1962/63 income of taxpayers in then-Western Nigeria.³

Earliest studies using countrywide survey data sets began in the 1980s. Canagarajah et al. (1997) using data from the National Consumer Survey (NCS) conducted in 1985/86 &

1992/93, reported increased income inequality. Aigbokhan (2000) estimated inequality using the 1985/86, 1992/93, and 1996/97 NCS. He finds increased consumption inequality and regional disparities. Ogwumike et al., (2006) used the 1998/99 General Household Survey (GHS) data to estimate inequality noting high inequality among employed households. Oyelere Uwaifo (2010) used four rounds of the GHS data set for 1997/1998, 1998/1999, 1999/2000, and 2005 to compare income inequality, pre and post democracy across gender and geopolitical zones noting significant increases over time. Several researchers have also made use of the National Living Standard Survey (NLSS) to examine economic inequality. For example, Oyekale et al. (2006) estimate a Gini of 0.58 using the 2003/2004 NLSS and Odozi et al. (2010) using the same data, but with a focus on the North-Eastern region estimated a Gini of 0.46.

In the last 15 years, more comprehensive datasets have emerged but papers using these datasets to accurately estimate economic inequality across individuals are few. The National Bureau of Statistics (NBS 2012) used the Harmonized Nigeria Living Standard Survey (HNLSS) 2009/2010 to estimate income Gini suggesting a 4.1% increase from its 2004 estimates. Aigbokhan (2017) employed the 2012/2013 and 2015/2016 waves of the GHS-Panel to estimate inequality. In contrast to NBS (2012) he notes an increase from 0.362 to 0.387 in income Gini. The most recent estimate of inequality was provided by NBS (2020). Using the latest NLSS for 2018–2019, they estimated a national consumption expenditure Gini of 0.35. This estimate is not directly comparable to NBS (2012) because the Gini was computed using consumption versus income.

The aforementioned literature provides a rich foundation on measuring economic inequality across individuals in Nigeria but several gaps exist. First, out of the three recent Gini estimates for Nigeria, two are based on income which has limitations. In particular, collecting accurate estimates of income in developing countries with high levels of informality is challenging. The preferred approach is to estimate inequality using consumption data. The Gini in the 2020 NBS report is based on consumption. However, the calculation of consumption in the NLSS survey can lead to imprecise estimates of inequality because the purchase price of durable goods is included in calculating consumption expenditures rather than the consumption flow from durable goods (Deaton and Zaidi 2002). In our paper to derive a more accurate picture of consumption inequality, we estimate inequality using consumption expenditure and calculate the flow from durable goods. We then include this estimated flow in the calculation of total consumption, and exclude the purchase price.⁴

² See Kosemani (1993), Aka (2000) and Archibong (2018) for evidence of disparities across regions. For example, Archibong (2018) used the Demographic Health Survey data sets for 1990 and 2013 to analyze horizontal inequality by ethnicity in access to education, wealth, and public services. The study finds persistent horizontal inequality in access to education, wealth, and federally administered public services and reduced horizontal inequality in access to locally administered services such as sanitation and water access.

³ See also Essang (1970) providing estimates for Western Nigeria and Adesina (2000) for Southern Nigeria.

⁴ See Amendola and Vecchi (2014) for a detailed discussion of durable goods and correct imputation in consumption expenditure and poverty analysis.

Data and Methodology

Data

The main dataset, we use in addressing our questions of interest is the Nigeria General Household Survey (GHS). As noted on the World Bank's Central Microdata Catalog website, *The GHS is implemented in collaboration with the World Bank Living Standards Measurement Study (LSMS) team as part of the Integrated Surveys on Agriculture (ISA) program and was revised in 2010 to include a panel component (GHS–Panel)*. The GHS–Panel is a nationally representative survey of about 5,000 households. This panel survey is representative of the geopolitical zones in Nigeria at both the urban and rural levels. It provides information on basic demographics, food and non-food expenditure and household income sources and community variables. There are four waves currently of the panel (2010, 2012 and 2015, 2018).

For the first three waves of the survey, only a few additional households were added. A major change was implemented in the fourth survey of 2018/2019. In particular, for the fourth wave of the GHS survey, a significant number of households in the prior three panels were dropped and replaced with 3,600 refresh households. Only 1507 households from the original 2010 panel were re-interviewed in 2018. This significant change combined with the normal marginal attrition of households given the length of time since the survey began, reduced significantly the size of the balanced panel over the four waves.⁵

We are not worried that the introduction of the refresh sample can introduce selection bias because the World Bank specifically chose this new sample to mirror the old sample that was dropped. Moreover, the sub-sample of households that were surveyed in all four waves now called the “long sample” was designed to be nationally representative and consist of 159 enumeration areas from the 6 zones in Nigeria. These enumeration area were systematically selected to ensure that the distribution across the 6 zones is proportional to the original sample. However, the small size of this long sample creates a challenge for empirical methods that are data intensive and could results in insignificant estimates. To avoid this potential problem, we make use of the unbalanced panel for the four survey periods in our analysis.⁶

To get an accurate view of the evolution of economic inequality in Nigeria, it is important how we measure inequality. To measure inequality more accurately and to

be consistent with current literature measuring economic inequality, we avoid using income to estimate inequality. Instead, we make use of consumption expenditure data in the survey.⁷ We evaluate inequality using two kinds of expenditure: Total Consumption Expenditure Per Adult Equivalence (TCEPAE) and Food Expenditure Per Adult Equivalence (FEPAE). For an accurate comparison of consumption expenditure over time, we convert all monetary values to real values using the base year of 2010.⁸

The GHS data does not include a measure of total consumption expenditure per adult equivalence and food expenditure per adult equivalence. We have to calculate these measures using information on expenditure available in the GHS data and information on household size and composition. In summing up total consumption expenditure we include the flow of consumption from durable goods and also estimate the cost of consumption from transfers and own production. We divide household consumption by adult equivalence an approach suggested by Deaton (2003). Our rationale for also providing results using food expenditure per adult equivalence as an alternative measure of consumption is linked with the challenges in estimating total consumption expenditure and the advantages of using a food expenditure measure despite its own limitations.⁹

Methodology

To investigate whether economic inequality in Nigeria declined between 2010 and 2018, first we used the Lorenz curve concept to rank the consumption expenditures per adult equivalence $Y = (y_1, \dots, y_n)$ of households $N = (1, 2, \dots, n)$ for each survey period. In particular, the cumulative proportion of consumption expenditure per adult equivalence is plotted on the y-axis against the cumulative proportion of households on the x-axis. We then compared the deviation of each of the four curves from the diagonal line.

While Lorenz curves provide a good pictorial representation of economic inequality, these curves are limited because they do not provide a precise measure of inequality. Moreover, when they cross, visual ranking of inequality is not possible. There are various ways inequality can be measured more precisely. The most common measure in development economics literature is the Gini coefficient (Gini (1936)).

⁵ See the World Bank micro-data website for more details on the sampling <https://microdata.worldbank.org/index.php/catalog/3557#metadata-sampling>

⁶ It is important to note that while estimates change if we restrict our data to the balanced panel for the four periods, our inferences and conclusions are robust to this smaller sample.

⁷ There are several reasons why using consumption is preferred to using income when measuring welfare including the fact that in many developing countries, income in household surveys is underestimated.

⁸ Through out the paper when we refer to these measures of expenditure, we are referring to the real values.

⁹ See Canagarajah et al. (1997) for a discussion on the benefits and challenges of these measures.

We will make use of the Gini to derive an exact measure of vertical consumption inequality for each survey year.

The Gini is calculated by taking difference between all pairs of consumption expenditure per adult equivalence and then totalling the absolute differences. This total absolute difference is then normalized by dividing by population (squared) and average income (Oyelere Uwaifo (2010)). In our case we use expenditure and not income. The Gini formula is expressed as follows:

$$G = \frac{\sum_{i=1}^n \sum_{j=1}^n |x_i - x_j|}{2N^2\mu} \quad (1)$$

where N is the total number of observations and μ is average expenditure and x_i, x_j are the values of individuals' expenditure.

We estimate our Gini coefficient using consumption expenditure per adult equivalence in each survey period. We then calculate changes in inequality as captured by the Gini index comparing the Gini coefficient in 2010 to the Gini coefficient in 2018. To explore the evolution in inequality across regions, we calculate the Gini coefficient for each region in each survey year and also calculate the change, comparing 2010 to 2018.¹⁰

To address the question as to whether inequality within geopolitical regions contributes more to inequality versus across these regions, we employ a decomposition by population subgroup. We split the population of households $N = (1, 2, \dots, n)$ into geographical regions $M = 1, 2, \dots, m$ where $m=6$. The six regions in Nigeria are the North Central, North East, North West, South East, South South and South West. We then employ a decomposition process of the Gini coefficient inequality measure, G . This decomposition allows us to quantify what contribution to total inequality is attributable to within region inequality versus between the geopolitical regions.¹¹

To analyze the contributions of the various components of a household consumption expenditure y_1, \dots, y_k to overall inequality, we follow the income source decomposition approach by Lerman and Yitzhaki (1985) and Stark, Taylor, and Yitzhaki (1986). We decomposed the Gini coefficient index using a Distributive Analysis Stata Package (DASP) by Abdelkrim and Duclos (2007) in Stata. We use consumption expenditure instead of income for this analysis. Equation 2, sums the consumption expenditure components for house-

hold i where y_{ik} equates to the sum of three main expenditure components: food, non-durables, and durables.

$$y_i = \sum_{k=1}^K y_{ik} \quad (2)$$

$$ACI_k = S_k * R_k * G_k \quad (3)$$

Equation 3 shows the estimation of the absolute contribution of an expenditure component k to the inequality. ACI_k is the product of S_k (share of consumption expenditure component k in y); R_k (Gini correlation between consumption expenditure component k and consumption expenditure) and G_k (Gini index for consumption expenditure component k). The Gini correlation R_k ranges between -1 and +1 and is estimated as shown in Eq. 4

$$R_k = \frac{cov(y_k, F)}{cov(y_k, F_k)} \quad (4)$$

where $cov(y_k, F)$ is the covariance of expenditure component k with the cumulative distribution of consumption expenditure F . $cov(y_k, F_k)$ is the covariance of expenditure component k with the cumulative distribution of consumption expenditure component F_k . Equation 5 shows the estimation of the relative contribution of each consumption component to the overall Gini. Where G is the Gini coefficient for total consumption expenditure and S_k, R_k and G_k are as earlier defined above

$$RCI_k = \frac{S_k * R_k * G_k}{G} \quad (5)$$

Results: Evolution of Inequality in Nigeria

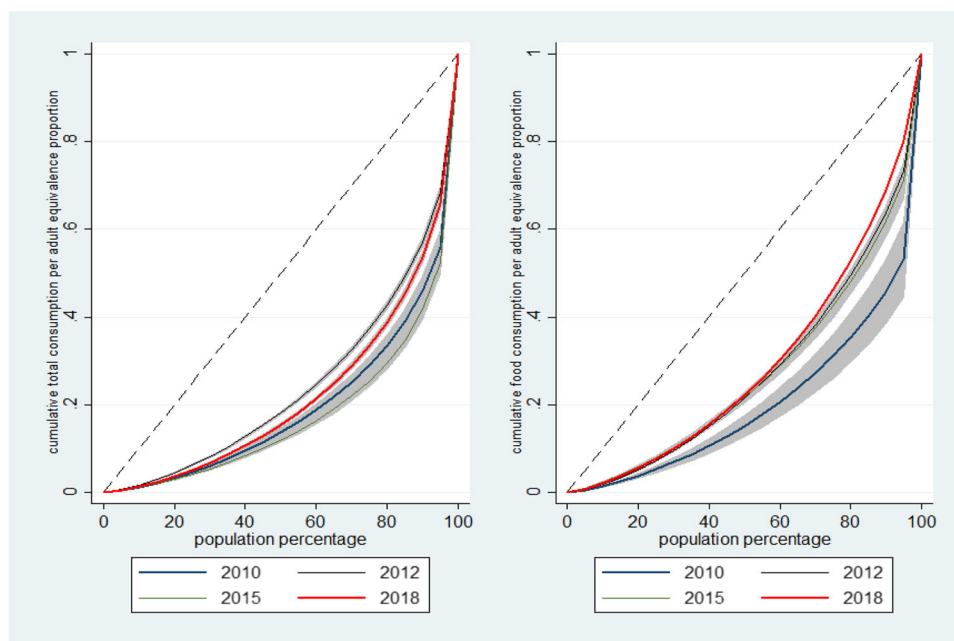
The first question, we addressed is whether inequality decreased between 2010 and 2018 in Nigeria. To answer this question as noted above, we first construct Lorenz curves (Fig. 1) using both total consumption expenditure per adult equivalence and food expenditure per adult equivalence.¹² The Lorenz curves both suggest that inequality decreased comparing 2010 to 2018. Table 1, Panels A and C show the estimated Gini coefficient for each survey year for the whole country and within regions in Nigeria. It also shows the change in inequality between 2010 and 2018 for the whole country and for each region. The national Gini coefficients summarized in Table 1 confirm the inference of declining inequality in Nigeria between 2010 and 2018, highlighted

¹⁰ Upon a close examination of our data, we note the presence of some extreme values in the food expenditure data. These high values are outliers which could be as a result of data entry or measurement error. To reduce the influence of these outliers on our results and improve the fit and robustness of our results, we trim the data. This trimming removes 11 observations in 2010 and 12 in 2015.

¹¹ See examples of this kind of decomposition in Bhattacharya and Mahalanobis (1967), Pyatt (1976), Mookherjee and Shorrocks (1982).

¹² Our main measure of inequality is total consumption expenditure per adult equivalence. However, we also present results using food expenditure per adult equivalence for completeness.

Fig. 1 Lorenz Curves: total consumption expenditure per adult equivalence and food expenditure per adult equivalence 2010–2018



in the Lorenz curves (Fig. 1). From the table, inequality as measured by the Gini decreased from 0.56 in 2010 to 0.50 in 2012 then increased significantly to 0.60 in 2015, and then dropped to 0.54 by 2018. Comparing 2010 to 2018, inequality decreased by 3.98%.¹³ It is important to note that our 2018 estimate is higher than the NBS(2020) estimate from the same period (0.54 vs 0.35). This suggests a downward bias in NBS estimates of inequality in 2018.¹⁴

To explore further the evolution of inequality in Nigeria over the 2010–2018 period, we calculate changes in inequality between each survey period. Figure 2 shows the percentage change in vertical inequality (Gini) based on Total Consumption Expenditure Per Adult Equivalent (TCEPAE) and Food Expenditure Per Adult Equivalent (FEPAE) across different time intervals for Nigeria and by regions. The change in inequality from 2010 to 2018 corroborates the results in Table 1 Panel A and C. The period between 2012 and 2015 marked an increase in consumption inequality on average in Nigeria. This increase in Gini is also noted within each region. In contrast, if we focus on measuring Gini based on food expenditure per adult equivalence we find a decrease in inequality for Nigeria as a whole from 2012 to 2015 but heterogeneity across regions in terms of increase or decrease in Gini between 2012 and 2015. While there appears to be more heterogeneity across regions in the direction of change

in inequality using our food expenditure measure versus the total expenditure measure, the overwhelming evidence points to a decrease in consumption inequality over the 2010–2018 time interval. Moreover, we find that the decline in inequality in Nigeria is not even across survey years or across the two measures of consumption inequality.

To examine a potential channel for the aforementioned decrease in inequality, we compute the changes in the median real total consumption expenditure per adult equivalence and median real food expenditure per adult equivalence over the period for Nigeria as a whole and across regions.¹⁵ These results are summarized in Table 1 panels B and D. Median total consumption expenditure per adult equivalence increased by 6.06% from 2010 to 2018 but median food expenditure per adult equivalence declined by 4.3%. Figure 3 captures the percent changes in the total expenditure measure and the food expenditure measure for Nigeria and for its geopolitical regions, over the survey years. The takeaway from both Fig. 3 and Table 1 are quite simple. While median total expenditure per adult equivalence for Nigeria did not increase consistently across survey years, there was an increase in this measure from 2010 to 2018. This increase could be a channel to explain how inequality decreased in Nigeria over this period. The contrasting decreases in median food expenditure per adult equivalence for Nigeria over the periods 2010–2012, 2015–2018, and 2010–2018 are

¹³ Finding a decline in vertical economic inequality is consistent with the finding of Archibong (2018) who noted decline in vertical and horizontal inequality in infrastructure and education albeit between 1990 and 2013.

¹⁴ Our results using Gini based on food expenditure per adult equivalence also suggests a substantial decline in inequality by $\approx 8.6\%$ from 2010 to 2018.

¹⁵ We do not compute the means but rather focus on the median given the data is not symmetrically distributed and contains extreme values. For ease of reading, we refer to median real total consumption expenditure per adult equivalence as our total expenditure measure and median real food expenditure per adult equivalence as our food expenditure measure.

Table 1 Gini and median consumption expenditures: Nigeria and geopolitical regions

	2010 (1)	2012 (2)	2015 (3)	2018 (4)	2010–2018(%) (5)
Panel A	Gini using total consumption expenditure per adult				Equivalence
Nigeria	0.56	0.50	0.60	0.54	–3.98
North central	0.57	0.46	0.54	0.55	–2.74
North east	0.57	0.50	0.52	0.57	1.34
North west	0.48	0.43	0.47	0.47	–0.88
South east	0.57	0.50	0.59	0.49	–12.76
South south	0.60	0.47	0.55	0.50	–17.26
South west	0.50	0.49	0.61	0.50	–0.46
Panel B	Real total consumption expenditure per adult				Equivalence (naira)
Nigeria	125,702.6	94,132.98	148,610.2	133,300	6.06
North central	126,257.4	85,279.73	148,822.6	126,344.8	0.07
North east	92,403.56	59,313.91	102,581.6	83,356.49	–9.79
North west	93,436.59	69,811.67	92,292.66	99,436.44	6.42
South east	140,564.1	108,632.9	179,847.5	192,397.7	36.88
South south	162,545.9	132,118.1	253,746.9	197,773.2	21.67
South west	174,402	146,241.9	235,500.2	210,310.9	20.59
Panel C	Gini using food consumption expenditure per adult				Equivalence
Nigeria	0.44	0.41	0.38	0.40	–8.55
North central	0.50	0.38	0.41	0.38	–24.33
North east	0.41	0.59	0.32	0.34	–15.45
North west	0.39	0.33	0.31	0.41	5.89
South east	0.57	0.34	0.32	0.39	–32.23
South south	0.38	0.46	0.38	0.36	–7.49
South west	0.37	0.33	0.40	0.34	–6.14
Panel D	Real food consumption expenditure per adult				Equivalence (naira)
Nigeria	56,891.26	46,292.86	57,080.54	54,448.43	–4.29
North central	54,933.34	42,453.56	48,151.47	44,484.04	–19.02
North east	43,549.1	30,549.96	49,027.81	37,649.56	–13.55
North west	51,775.38	43,875.48	48,728.04	42,059.99	–18.76
South east	56,837.39	49,373.94	65,553.95	79,958.24	40.68
South south	70,641.36	54,419.2	86,115.59	78,732.92	11.45
South west	71,027.27	53,358.34	60,764.78	72,606.35	2.22
N	28,375	30,295	32,917	33,355	

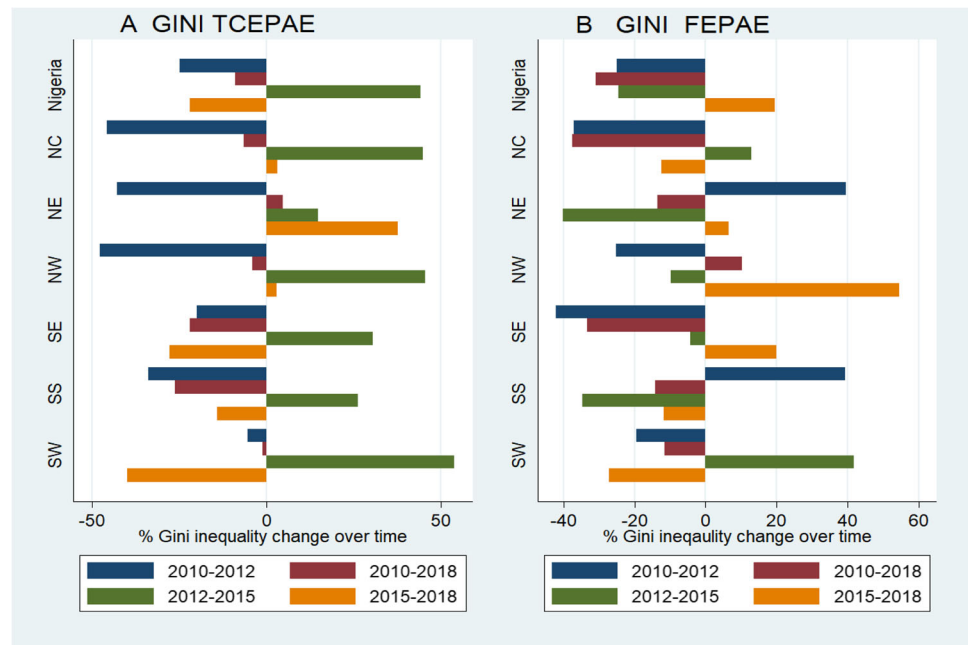
noteworthy. This decrease in median food expenditure per adult equivalence suggests that welfare in Nigeria may not have improved for those below the median, despite a decrease in the Gini coefficient measured using food expenditure.¹⁶

Given that our results show an increase in the total expenditure measure from 2010 to 2018 but a decrease in the food

expenditure measure, it is useful to explore the breakdown of total consumption to see what parts of these expenditures increased over time. Table 2 provides some answers. It captures the median values of the components of total expenditure per adult equivalent. We provide information on this breakdown in 2010 and 2018 and calculate the change in each component. Table 2 suggests that the increase in median expenditure is linked primarily with increased spending on durables, meals away from home, clothing/footwear,

¹⁶ The noted trend in real total consumption expenditure per adult equivalence between 2010 and 2018 is consistent with the trend in Gross Domestic Product (GDP) per capita over the period. In particular, real GDP per capita increased between 2010 and 2012 and declined between 2015 and 2018.

Fig. 2 Percentage change in Gini inequality in TCEPAE and FEPAE, 2010–2018



nonfood expenditures, and education. In contrast, median expenditure on food and health declined.¹⁷

Typically, when a decline in inequality and an increase in median total expenditure are noted for a country, it signals economic progress/development. In the Nigerian case, since the aforementioned changes were also accompanied with a decline in the food expenditure measure, it is necessary to consider alternative measures of economic progress focused on the lower end of the income distribution. Using expenditure data versus income, we estimate poverty incidence (P_0), poverty gap (P_1), and poverty severity (P_2) in each survey. We subsequently compute the changes in these measures between each consecutive survey year and between 2010 and 2018.¹⁸

Table 3 summarizes poverty estimates for Nigeria as a whole and for each region. The estimates were derived using the Foster-Greer-Thorbecke (FGT) class of poverty measures (Foster et al. (1984)) which are incidence, gap, and severity of poverty. Poverty incidence P_0 is a measure of the percentage of the population with per capita income below the poverty line. In our case, we replace per capita income with total

consumption expenditure per adult equivalence. The poverty gap P_1 is a measure of the degree of poverty. It measures the extent to which an individual's income/expenditure on average falls below the poverty line. P_2 is a measure of poverty severity. It is calculated as the square of the poverty gap and is more sensitive to income/consumption expenditure changes in poorer households. Figure 4 provides a graphical presentation of the percentage point changes in poverty incidence for Nigeria as a whole, and for each geopolitical region from 2010 to 2012; 2012 to 2015; 2015 to 2016, and for the whole period (2010–2018). Our results in Table 3 and Fig. 4 show that poverty has increased significantly over time in Nigeria. There is only one-time interval where poverty incidence decreased for Nigeria as a whole and in each region: 2012–2015. Coincidentally, this is the only period with both increases in total median consumption expenditure per adult equivalence and median food expenditure per adult equivalence. In particular, for Nigeria as a whole, poverty incidence increased by 22.6 percentage points from 21.6% in 2010 to 44.2% in 2018. The poverty gap also increased by 10.3 percentage points over the period, and poverty severity increased by 5.75% points.¹⁹

The substantial increase in poverty incidence (P_0) and decrease in the food expenditure measure even as the consumption expenditure measure increased and inequality declined, warrants further investigation.²⁰ While deciphering

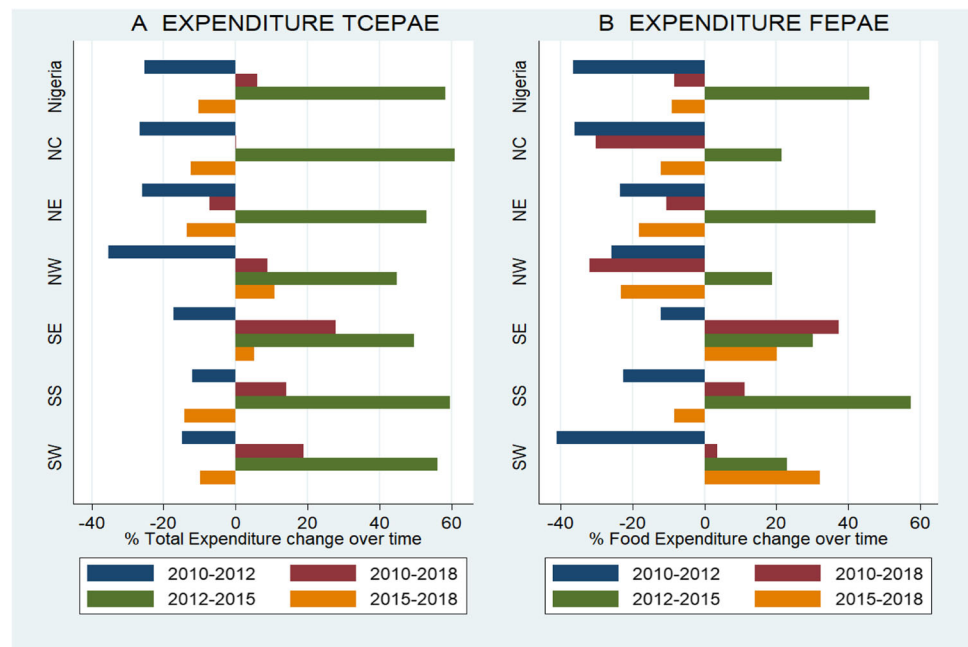
¹⁷ We cannot calculate change for certain expenditure categories because those categories were merged with other categories in 2018. In addition, we calculate percentage change using the median point method for the education category given median value in 2010 was 0. All other changes in expenditure categories are calculated with the standard method.

¹⁸ See Foster et al. (1984) for more information on how these poverty measures are calculated. We derive the poverty line for each year of data using information from the World Bank and convert these poverty lines to Naira (local currency) using the relevant exchange rates for each year of data.

¹⁹ It is noteworthy that P_0 and P_2 have more than doubled amounting to over a 100% change.

²⁰ The rising poverty and falling inequality trend are robust to restricting the sample to the balanced panel over the four data panels. These results are available upon request.

Fig. 3 Percentage change in Median TCEPAE and FEPAE 2010–2018



the exact reason for this contrasting finding is beyond the scope of this paper, a potential explanation is a more rapid increase in population growth over time among the poor than the nonpoor. Some suggestive evidence for this uneven population growth over time was noted in our data. We calculated both the mean and median household size for those in poverty and those who are nonpoor for our 4 survey years. We find that household size increased over the 2010–2018 period for the poor while it slightly decreased for the nonpoor. It is important to note that other factors

could also provide an explanation for the contrasting finding noted above. Regardless, the significant takeaway from these results is that decreases in inequality do not necessarily translate to improvement in welfare for those at the lower percentiles of the income distribution. Poverty can increase as inequality decreases. This is the Nigeria story over the 2010–2018 period.

Our second question is focused on testing for evidence of convergence in inequality across regions and figuring out if differences across zones/regions in expenditure contribute

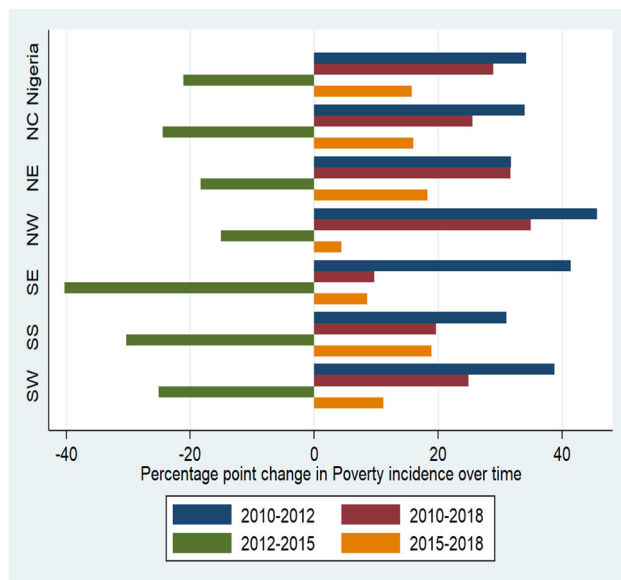
Table 2 Components of median total expenditure per adult equivalent (Naira)

Consumption expenditure components	2010	2018	% Change
Food(Purchased, own produced, gifts)	49,949.297	42,963.27	−13.986
Meals away from home	3239.875	4614.608	42.432
Health*	484.2	209.909	−56.648
Refuse disposal	0	NA	—
Thatching roof materials	0	NA	—
Miscellaneous (carpet, health insurance, marriage, and funeral)	0	0	0
Clothing, footwear, utensils, donations	2617.612	4026.105	53.808
Nonfood*	5268.292	7193.981	36.552
cigarette, matches, public transport, and newspaper	252.019	1868.335	641.347
Education*	0	368.984	200
Durable consumption flow/annum	34,565.719	40,533.63	17.265

Note: *Nonfood expenses consist of energy, water/cleaning items, phone/internet bills, rent, mortgage/personal care, car/motorbike maintenance); Durables flow is an estimate calculated based on expenditure on goods such as furniture, mattress, bed, mat, sewing machine, gas cooker, stove, fridge, bicycle, and motorbike; *Education expenditure includes school fees, PTA, Uniform, Books, transport, boarding fees, extra tuition, and other; *Health expenditure includes consultation fee, transport, drugs, hospital bill, medicine, out of pocket expenses, bednet; Thatch materials:(bamboo, wood poles, and grass) Refuse disposal and Thatch expenditure were removed as categories in 2018 and added to non-food expenditure. We calculate percent change using the mid point method for the education category given 2010 value is 0

Table 3 Poverty measures 2010–2018 (using consumption per adult equivalence)

	2010 (%) (1)	2012 (%) (2)	2015 (%) (3)	2018 (%) (4)	2010–2018 (% point Δ) (5)
Panel A	Poverty incidence				
Nigeria	21.61	48.39	31.86	44.23	22.62
North central	21.49	53.29	30.43	45.39	23.90
North east	32.59	68.53	47.81	68.48	35.89
North west	31.22	68.34	56.12	59.67	28.46
South east	20.19	39.26	20.71	24.65	4.46
South south	11.20	31.38	11.66	24.01	12.81
South west	8.87	23.63	14.09	18.34	9.47
Panel B	Poverty gap				
Nigeria	6.62	18.53	10.06	16.94	10.33
North central	6.50	20.80	10.81	16.57	10.06
North east	10.04	32.98	15.94	29.07	19.03
North west	9.00	25.25	17.82	23.73	14.73
South east	6.51	13.58	5.33	7.99	1.48
South south	3.87	10.72	3.49	7.71	3.83
South west	2.94	7.04	3.74	5.45	2.51
Panel C	Poverty severity				
Nigeria	2.83	9.43	4.39	8.59	5.75
North central	2.97	11.12	5.50	8.46	5.49
North east	4.28	19.26	7.14	15.48	11.20
North west	3.57	11.79	7.50	12.17	8.60
South east	2.78	6.18	1.99	3.51	0.73
South south	1.79	5.02	1.53	3.50	1.72
South west	1.43	3.12	1.48	2.37	0.94
<i>N</i>	28,375	30,295	32,917	33,355	

**Fig. 4** Percentage point change in poverty incidence 2010–2018

more to national inequality than within region differences. As noted in the introduction, examining differences across regions is pivotal in Nigeria given the geopolitical nature of these groups and their role in the distribution of resources. The Gini estimates by region are summarized in Table 1 Panel A and C. In addition, Fig. 2 summarizes changes in the Gini estimates between each survey period by region. Real median total consumption expenditure per adult equivalence and food consumption expenditure per adult equivalence estimates by region are summarized in Table 1 panels B and D. In addition, Fig. 3 provides estimates of changes in both measures of expenditures over each survey period, by region.

The results in Table 1 paint a picture of significant heterogeneity across regions within Nigeria in 2010 and 2018. We find evidence of convergence when comparing the range of estimated Gini coefficients for regions in 2010 with 2018 estimates. We also find that inequality declined in all regions but the North East. In the North East region there was a 1.3% increase in inequality. This region also had the highest Gini

coefficient in 2018. In 2010 inequality was higher on average in the southern regions but this flipped by 2018 with northern regions on average exhibiting higher within region Gini.²¹ Figure 2 shows the differences in the change in Gini across regions with higher decreases in the southern regions between 2015 and 2018 and the entire period 2010–2018. This faster decreases explains why inequality converged across regions given the higher levels of inequality in the southern regions in 2010. Our results also provide evidence of convergence across regions in estimates of inequality using food expenditure per adult equivalence. The variance across estimated Gini by region declined over time.

While within region Gini coefficients appear to be converging, our results suggest significant divergence across regions in both food and total consumption expenditure measures. Both Table 1 panels B and D and Fig. 3 provide evidence consistent with this trend. In 2010, the three southern regions had the highest median total consumption expenditure per adult equivalence and these three regions had the highest growth in this measure between 2010 and 2018 (36.9%, 21.7%, and 20.56%). In contrast, average growth in total consumption expenditure per adult equivalence was only 0.01% in the North Central region and 6.4% in the North West. The total expenditure measure shrunk in the North Eastern region by 9.8%. This decline in consumption in a region that has suffered significantly from armed conflict since 2009 is consistent with findings in Odozi and Uwaifo Oyelere (2019), who provide evidence of the impact of conflict on different measures of welfare. In terms of food expenditure per adult equivalence, our results show that the overall decline of 4.3% by 2018 was driven solely by a decline in all the Northern regions. Food expenditure per adult equivalence shrunk in all Northern regions (−19.2%, −18.8% –13.6%) but increased significantly in all Southern regions (40.68%, 11.5%, and 2.2%). Figure 3 panel B which depicts the changes across regions in food expenditure per adult equivalence across survey periods also shows this positive increase for the Southern regions between 2010 and 2018 in contrast to the decrease for the Northern regions. Figure 3 also shows that it was only between 2012 and 2015 that the food expenditure measure increased for all regions.

In terms of the question of what contributes more to the national level of inequality, our decomposition calculation suggests that between region differences contribute more than within region differences in every survey year. In 2010, the Gini between regions contributed 41.3% to overall inequality but this share decreased to 34.3% by 2018. In contrast, inequality within regions contributed 15.1% in 2010 and 15.9% in 2018. When we decomposed the food

expenditure per adult equivalence Gini, we find a similar trend. While Gini between regions contributed more to inequality in both 2010 and 2018, the gap in contributions declined by 2018. In contrast, the contribution of within region differences increased. This result together with the other findings from Tables A panel B and D suggest that while within regional differences in consumption exist and should be attenuated, the major challenge is the growing disparities between regions. In particular, the growing gap between the Northern and Southern regions in consumption especially food expenditures requires government attention and further research.

The significant disparities across the Northern and Southern regions are corroborated with the estimates of poverty by region, and the changes in poverty overtime summarized in Table 2 and Fig. 4. In 2010 the Northern regions had higher levels of poverty and this trend persists in 2018. What is more concerning is that while poverty incidence has increased across all regions in Nigeria between 2010 and 2018, the increases in the Southern regions are significantly smaller than the Northern regions. Similar to Fig. 3 that highlights increases in total consumption expenditure per adult equivalence and food expenditure per adult equivalence only between 2010 and 2015, Fig. 4 also shows that it is only between 2012 and 2015 that poverty incidence decreased in all regions with bigger decreases in the Southern regions. When we look over the entire period and compare 2010 to 2018, we note that poverty incidence (P_0) increased in the Northern regions by approximately 35, 28, and 24 percentage points respectively. In contrast, poverty incidence increased by approximately 13, 9, and 4 percentage points respectively in Southern regions. This increase in poverty in the South is far less than the increases highlighted above for the Northern regions. The poverty gap (P_1) has also grown across all regions in Nigeria but the growth in the Northern regions is again significantly higher than the Southern regions. Poverty severity (P_2) follows a similar trend. In particular in all the Northern regions, poverty severity more than doubled while in the Southern regions it increased but the change is much less. The divergence across the Northern and Southern regions in poverty incidence (P_0), poverty gap (P_1) and poverty severity (P_2) from 2010 to 2018, is consistent with the divergence across the Northern and Southern regions in the total expenditure and food expenditure measures over this same period. Furthermore, the declining food expenditure measure in Northern regions could be as a result of the significant increase in poverty in these regions.

Finally, to better understand the sources of inequality in consumption over time in Nigeria, we follow the approach to the decomposition of inequality by income sources highlighted in the methodology part of Section 3. As noted above, we implement this decomposition in Stata using a Distributive Analysis Stata Package (DASP). Similar to the rest

²¹ In Table 1 Gini coefficients are approximated to just two decimals for ease of presentation but the change between 2010 and 2018 is computed based on the full Gini estimate.

of our paper, we use consumption instead of income for this analysis. Consumption expenditure can be divided into three main sources: food, non-durables and durables. In column (1) of Table 4, the share of each expenditure source in total consumption expenditure per adult equivalence (S_k) is presented and in column (2) the expenditure source Gini

(G_k) is summarized. In column (3) the contribution of each consumption source Gini share to overall Gini is summarized and in column (4) the relative contribution to overall inequality is presented. Each panel is a summary for a survey year.

Table 4 Consumption expenditure source decomposition over time

	(S_k) Share of Expenditure source (1)	G_k Source Gini (2)	Absolute Contribution (3)	Relative Contribution (4)
Panel A	Year 2010			
Real food expenditure per adult equivalent	0.338 (0.007)	0.441 (0.007)	0.122 (0.004)	0.217 (0.009)
real nondurable expenditure per adult equivalent	0.135 (0.003)	0.605 (0.005)	0.066 (0.002)	0.118 (0.004)
Real durable expenditure per adult equivalent	0.527 (0.009)	0.750 (0.008)	0.375 (0.011)	0.666 (0.011)
Panel B	Year 2012			
Real food expenditure per adult equivalent	0.398 (0.005)	0.412 (0.005)	0.136 (0.003)	0.270 (0.008)
real nondurable expenditure per adult equivalent	0.211 (0.005)	0.603 (0.010)	0.109 (0.005)	0.217 (0.009)
Real durable expenditure per adult equivalent	0.391 (0.007)	0.717 (0.007)	0.258 (0.008)	0.513 (0.012)
Panel C	Year 2015			
Real food expenditure per adult equivalent	0.236 (0.004)	0.383 (0.004)	0.065 (0.002)	0.108 (0.003)
real nondurable expenditure per adult equivalent	0.128 (0.004)	0.619 (0.015)	0.069 (0.005)	0.115 (0.007)
Real durable expenditure per adult equivalent	0.636 (0.005)	0.750 (0.004)	0.466 (0.006)	0.777 (0.008)
Panel D	Year 2018			
Real food expenditure per adult equivalent	0.299 (0.005)	0.404 (0.003)	0.093 (0.002)	0.172 (0.005)
real nondurable expenditure per adult equivalent	0.144 (0.002)	0.521 (0.003)	0.063 (0.001)	0.116 (0.003)
Real durable expenditure per adult equivalent	0.557 (0.006)	0.721 (0.006)	0.386 (0.008)	0.712 (0.007)

Note: standard error in parentheses

The results show that a significant portion of inequality in total consumption expenditure per adult equivalence is stemming from inequality in the consumption flow from durable-goods expenditure per adult equivalence. The relative contribution of durables to inequality is greater than its share in total consumption expenditure per adult equivalence each survey year and has increased between 2010 and 2018. While the level of inequality in durables across households has decreased, this Gini is still high (0.721). In contrast, the Gini for non-durable goods expenditure per adult equivalence has decreased overtime and both its absolute and relative contribution to inequality has decreased. Inequality in food expenditure decreased as noted above and its relative contribution to inequality decreased over the period. The decrease in the relative contribution to inequality from food expenditures is greater than the decrease linked with non-durable expenditures. We can infer from these results that the decrease in inequality by 2018 was driven primarily by a decrease in inequality in food expenditures.

Summary, Conclusion, and Policy Implications

In this paper, we focus on the evolution of vertical economic inequality and consumption in Nigeria as a whole and across geopolitical regions. Our period of analysis is 2010–2018. First, we estimate inequality using Gini and evaluate its evolution over the period of analysis. Our results suggest a decline in inequality in Nigeria from 2010 to 2018, corroborating other earlier studies. We also find that despite the 6% increase in median total consumption expenditure per adult equivalence, median food expenditure per adult equivalence decreased by 4%. More concerning is the noted increase in poverty measures over this period. Poverty incidence rose by 22.6 percentage points, poverty gap increased by 10.3 percentage points and poverty severity more than doubled. These results suggest that welfare for those at the lower end of the distribution has decreased overtime which is consistent with the current sentiment of declining living standards in Nigeria for many households. Higher population growth among the poor versus the nonpoor is our hypothesized explanation for this contrasting finding but other explanations are possible.

Our second question focused on investigating convergence across regions in simple measures of welfare. While we find evidence of convergence between 2010 and 2018 in measured within region Gini, median consumption expenditures diverged across regions. In particular, Southern regions experienced much higher increases in expenditure than Northern regions, further exacerbating differences in total consump-

tion expenditure per adult equivalence noted in 2010.²² We also note divergence across regions in poverty incidence, poverty gap and poverty severity. Most of the increase in poverty incidence, severity and gap in Nigeria is driven by significant increases in the Northern regions. Our result also show that the decline in inequality in Nigeria overtime is driven for the most part by a decrease in inequality in food expenditure. Notice that the relative contribution of food expenditure to inequality decreased from 2010 to 2018. In contrast, the relative contribution of durable expenditure to inequality increased.

Our results raise questions that set the stage for further research. For example, why has there been a significant rise in poverty especially in Northern Nigeria, despite GDP per capita growth in Nigeria of 4.5% over this period? Based on past research by Odozi and Uwaifo Oyelere (2019), an increase in armed conflict appears to be one reason but others factors could also contribute to this trend. Second, what are the determinants of inequality across geopolitical regions in Nigeria and are they changing over time? Third, why has convergence in welfare across regions in Nigeria been limited? These are important questions that need answers for there to be effective policy actions to ameliorate this situation. Finally, our results provide a cautionary tale about the importance of looking at multiple indicators of welfare. Increases in median consumption expenditures may not provide a robust picture of welfare improvement for households in a country. Although the median person in Nigeria consumed more in real terms in 2018 than 2010, poverty increased precipitously. Given that the first of the 17 adopted Sustainable Development Goals (SDGs) in 2015 is to end poverty in all its forms everywhere, rising poverty in Nigeria is antithetical to this goal and warrants robust policy action.

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Availability of Data and Materials Public use dataset downloaded from www.microdata.worldbank.org. Application for access needed.

Declarations

Ethical Approval Not applicable

Competing Interests The authors declare no competing interests.

²² The only region with a decline in median total consumption expenditure per adult equivalence by 2018 is the North-East.

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References

- Abdelkrim A, Duclos J-Y. DASP: stata modules for distributive analysis (PEP, World Bank, UNDP and Université Laval); 2007, 6 1226–38.
- Archibong B. Historical origins of persistent inequality in Nigeria. *Oxf Dev Stud.* 2018;46(3):325–47.
- Adesina JO. Income distribution and inequality: gender, labour market status and macro-economic policy. *Afr Sociol Rev.* 2000;4(1):1–34.
- Aigbokhan BE. Poverty, growth and inequality in Nigeria: a case study. Kenya: AERC Research Paper 102 African Economic Research Consortium;2000.
- Aigbokhan BE. The price inequality in Nigeria. Presidential Address Delivered at the 58th Annual. 2017. Retrieved from www.sau.edu.ng/download/ThePriceOfInequality.pdf
- Ajakaiye O, Jerome AT, Olaniyan O, Mahrt K, Alaba OA. Spatial and temporal multidimensional poverty in Nigeria- OUP; 2016.
- Aka EO. Regional disparities in Nigeria's development: lessons and challenges for the twenty-first century. Lanham, MD: University Press of America; 2000.
- Amendola N, Vecchi G. Durable goods and poverty measurement. World Bank Policy Research Working Paper, 2014. p 7105.
- Bhattacharya N, Mahalanobis B. Regional disparities in household consumption in India. *J Am Stat Assoc.* 1967;62:143–61.
- Canagarajah S, Ngwafon J, Thomas S. The evolution of poverty and welfare in Nigeria, 1985–1992. World Bank Policy Research working paper No. 1715, 1997. Retrieved from <http://www-wds.worldbank.org/external/>.
- Deaton A. Household surveys, consumption, and the measurement of poverty. *Econ Syst Res.* 2003;15(2):135–59.
- Deaton A, Zaidi S. Guidelines for constructing consumption aggregates for welfare analysis (English). Living standards measurement study (LSMS) working paper, no. LSM 135 Washington, D.C.: World Bank Group. 2002. <http://documents.worldbank.org/curated/en/206561468781153320/Guidelines-for-constructing-consumption-aggregates-for-welfare-analysis>.
- Essang S. The distribution of earnings in the Cocoa economy of Western Nigeria: implications for development. Ph.D. dissertation, Michigan State University;1970.
- Foster J, Greer J, Thorbecke E. A class of decomposable poverty measures. *Econometrica: J Econ Soc.* 1984: 761–766.
- Gini C. On the measure of concentration with special reference to income and statistics. Colorado College Publication, General Series: 1936, 208. p 73–9.
- Kosemani JM. The historical background to contemporary educational disparity in Nigeria. In: Educational Disparity: The Nigeria Situation. Africa Heritage Research: 1993.
- Lerman RI, Yitzhaki S. Income inequality effects by income source: a new approach and applications to the US. The review of economics and statistics: 1985. p. 151–156.
- Nigeria National Bureau of Statistics. General Household Survey, Panel (GHS-Panel) 2018–2019. 2022. Dataset downloaded from www.microdata.worldbank.org.
- Nigeria National Bureau of Statistics. General Household Survey, Panel (GHS-Panel) 2010/2011, 2012/2013, 2015/2016. Dataset downloaded from www.microdata.worldbank.org
- NBS (National Bureau of Statistics). Nigeria Poverty Profile 2010. Abuja, Nigeria: National Bureau of Statistics; 2012.
- NBS (National Bureau of Statistics). 2019 Poverty and Inequality in Nigeria: Executive Summary. Abuja, Nigeria: National Bureau of Statistics; 2020.
- Mookherjee D, Shorrocks A. A decomposition analysis of the trend in UK inequality. *Econ J.* 1982;92:886–992.
- Odozi JC, Awoyemi TT, Omonona BT. Regression-based decomposition analysis of household income inequality in Northeast Nigeria. *J Sustain Dev.* 2010; 6(1).
- Odozi JC, Uwaifo Oyelere R. Violent conflict exposure in Nigeria and economic welfare (No. 12570). IZA Discussion Papers: 2019.
- Ogwumike FO, Alaba OA, Alaba OB, Alayande BA, Okojie CE. Labour force participation, earnings and inequality in Nigeria. International Household Survey. Network. 2006. http://www.sarpn.org/documents/d0002270/Labour-force_Nigeria_Oct2006.pdf.
- Oyekale AS, Adeoti AI, Oyekale TO. Measurement and sources of income inequality in rural and urban Nigeria. A paper presented during the 5th PEP Research Network general meeting. Addis Ababa, Ethiopia: 2006.
- Oyelere Uwaifo R. Disparities in the benefits from democratic reform in Nigeria: a gender perspective. *Dev Econ.* 2010;48(3):345–75.
- Pyatt G. On the interpretation and disaggregation of Gini coefficients. *Econ J.* 1976;86:243–55.
- Stark O, Taylor JE, Yitzhaki S. Remittances and Inequality. *Econ J.* 1986;96(383):722–40.
- Teriba O, Philips A. Income distribution and national integration. *Niger J Econ Soc Stud.* 1971;13(1):77–122.

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