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ABSTRACT

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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 explore 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 regions over this period. Our last question is focused on identifying the sources/factors contributing to inequality in Nigeria over time. Leveraging data from the four waves of the Nigeria General Household Panel Survey (GHS) and carefully measuring inequality using consumption expenditure, our results suggest that inequality has decreased and median consumption expenditure increased. At the same time, poverty incidence and severity increased precipitously. Our findings suggest convergence in estimated inequality by regions but we do not find evidence of convergence across regions in consumption or poverty levels. We also find that durable goods expenditures are the biggest contributor to inequality across expenditure sources. Finally, our results suggest that education and living in an urban area are significant contributors to inequality but their effects have declined over time.

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1 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 suggests a decline in inequality and poverty, anecdotal evidence points to falling living standards and significant heterogeneity across regions in welfare. These seeming contradictions call for a more careful examination of the evolution of inequality.

In this paper, we focus on three 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 in inequality and consumption across regions and do differences across regions contribute more to national inequality than differences within? Finally, we explore the sources of inequality or what part of consumption expenditure or household and community characteristics contribute more to inequality. To answer these questions 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 mostly on the Gini coefficient as our measure of inequality (Gini 1936). We estimate our Gini coefficient on consumption expenditure versus income.[1] We estimate the Gini for Nigeria in all survey periods and for each region in each survey year. We also estimate poverty incidence, poverty severity and poverty gap for Nigeria as a whole and in each region of Nigeria for each survey period. To explore the sources of inequality we decompose inequality first following the Lerman and Yitzhaki (1985) approach and then using the regression based decomposition approach by Morduch and Sicular (2002).

Our results suggest that inequality in consumption decreased by 13.5% between 2010 and 2018. In contrast, poverty incidence increased by 22 percentage points. The rise in poverty is surprising given the 6% increase in consumption expenditure over this period. In addition, while our results suggest that regional estimates of inequality converge over time, median consumption estimates by region are not converging. Furthermore, inequality across regions contributes significantly more to the national inequality estimate than within region differences. We also find that inequality in the flow from durable goods consumption is the highest contributor to our estimate of consumption expenditure inequality. Finally, our results suggest that education and being in urban areas are two significant contributors to higher inequality in consumption expenditure. However, the contribution of these factors to inequality attenuated from 2010 to 2018. The decline in the role of education and living in urban areas to inequality are possible explanations for the decline in overall inequality in

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[1]We also consider the correlation of variation (CV) of consumption expenditure as a measure of inequality when we use the regression-based decomposition to explore contribution to inequality.

Nigeria over this period.

Our paper contributes to the literature by providing careful estimates of inequality and its evolution in Nigeria. We also shed light on the contributors to inequality in terms of expenditure sources and explanatory variables. This information is useful to inform future policy initiatives. Given the significant role of Nigeria in Africa, having reliable recent estimates of 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 welfare improvements could be misleading. While inequality has decreased and real median consumption increased in Nigeria, poverty incidence, gap and severity have also increased and median food consumption has decreased. These contrasting outcomes call into question the idea of improvement in welfare in Nigeria over the 2010 to 2018 period.

2 Literature Review: Inequality in Nigeria

Inequality in Nigeria is multidimensional and most of the past literature suggests disparities in income, expenditure, and other non-monetary arguments across regions. [2] Deriving income inequality estimates began over four decades ago in Nigeria and early papers provided estimates solely for regions. For example, Teriba and Philips (1971), estimated the Gini coefficient using the 1962/63 income of taxpayers in then-Western Nigeria.[3]

The 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 1985/86, 1992/93, and 1996/97 NCS. He finds increased consumption inequality and regional disparities. Ogwumike et al., (2003) used the 1998/99 General Household Survey(GHS) data to estimate inequality noting high inequality among employed households. Oyelere (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. Several researchers have also made use of the National Living Standard Survey (NLSS) to examine 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 inequality are few. The National Bureau of Statistics (NBS 2010) used the Harmonized Nigeria Living Standard Survey (HNLSS) 2009/2010 to estimate

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[2]See Kosemani, 1993 and Aka, 2000, for evidence of disparities across regions.

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

income Gini suggesting a 4.1% increase from 2004 estimates. Aigbokhan (2017) employed the 2012/2013 & 2015/2016 waves of the GHS-Panel to estimate inequality. In contrast to NBS (2010), 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 2018-19, they estimated a national consumption expenditure Gini of 0.35. This estimate is not directly comparable to NBS(2010) because the Gini was computed using consumption versus income.

The aforementioned literature provides a foundation 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 consumption expenditures rather than the consumption flow from durable goods (Deaton and Zaidi 2002). In our paper to derive a more accurate picture of inequality, we estimate inequality using consumption expenditure and include the flow from durable goods and not the purchase price.[4]

3   Data and Descriptive Analysis

To address our questions of interest, we make use of the GHS. There are four waves currently of this panel (2010/2011, 2012/2013 2015/2016, and 2018/2019). The GHS panel is a nationally representative survey of approximately 5,000 households. A major change was implemented in the survey of 2018/2019. In particular, a significant number of households in the prior three panels were dropped and replaced with 3,600 refresh households. Only 1,507 households (nationally representative) from the original 2010 panel were re-interviewed in 2018.[5] This significant reduction in the households originally interviewed in 2010 in the most recent 2018 survey creates some estimation challenges which necessitates our use of the unbalanced panel.

To measure inequality more accurately we avoid using income and instead use consumption. To sum up total consumption, we include the flow of consumption from durable goods and estimate the cost of consumption from transfers and own production. We divide household consumption by adult equivalence an approach suggested by Deaton (2003). In addition, for an accurate comparison of consumption expenditure over time, we convert all monetary values to real values using the base year of 2010. We evaluate inequality using two kinds of

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

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

expenditure: Total Consumption Expenditure Per Adult Equivalence (TCEPAE) and Food Expenditure Per Adult Equivalence (FEPAE). Our rationale for also providing results using FEPAE is linked with the challenges in estimating total consumption expenditure and the advantages of using a food expenditure measure despite its own limitations.[6]

4 Methodology/ Empirical Strategy

To investigate whether inequality in Nigeria declined between 2010 and 2018, first we used the Lorenz curve concept to rank the consumption expenditures per adult equivalence $Y = (y_1, ..., y_n)$ of households $N = (1, 2, ..., n)$ 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. To derive an exact measure of inequality for each survey year, we calculate the Gini coefficient (Gini 1936). We estimate our Gini coefficient using consumption expenditure per adult equivalence in each survey period versus income. 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.

To address the question as to whether within zone inequality contributes more to inequality versus across zones, we employ a decomposition by population subgroup. We split the population of households $N = (1, 2, ..., n)$ into geographical zones $M = 1, 2, ..., m$ 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 quantify what contribution of total inequality is attributable within and between the geopolitical zones through a decomposition process of the Gini coefficient inequality measure, G.[7]

The decomposition is expressed below:

$$G = G_B + \sum a_m G_m + R \qquad (1)$$

Where G_B is the between-zonal groups Gini coefficient, a_m is the product of the population share and expenditure share going to zone m, G_m is the Gini coefficient for expenditure within zone m. While R is a residual that takes the value of zero if no overlap exists among zonal expenditure rangesn(Lambert and Aronson, 1993). We implement this population decomposition method in Stata using the *ineqdecgini* command.

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[6]See Canagarajah (1997) for a discussion on the benefits and challenges of these measures.

[7]See examples of this kind of decomposition in Bhattacharya and Mahalanobis (1967), Pyatt (1976), Mookherjee and Shorrocks (1982)

To analyze the contributions of the various components of a household consumption expenditure $y_1, ..., y_k$ 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 household i where y_{ik} equates to the sum of three main expenditure components: food, non-durables, and durables.

$$y_i = \sum_{k=1}^{K} y_{ik} \tag{2}$$

$$ACI_k = S_k * R_k * G_k \tag{3}$$

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 equation (4)

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

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

$$RCI_k = \frac{S_k * R_k * G_k}{G} \tag{5}$$

The final approach we explore in our analysis is the regression-based decomposition proposed by Morduch and Sicular (2002). The methodology is an advancement of the above traditional decomposition approaches highlighted above. Following Cowell and Fiorio(2006), we assume an income-generating function expressed as:

$$\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\epsilon} \tag{6}$$

Where $\mathbf{y}$ is an n X 1 vector that captures the log of adult equivalent per capita expenditure of a household, $\mathbf{X}$ is an n X K matrix of household and community variables, $\boldsymbol{\beta}$ is a K X 1

vector of parameters interpreted as the effects of the explanatory variables on consumption expenditure. ϵ is an n X 1 vector of residuals.

Our explanatory variables include years of schooling, head of household age, household size, a dummy variable for experiencing a shock, population density, recent conflict intensity, rainfall, regional variable dummies, social capital variables (number of disabled associations, number of vigilante groups, number of NGO groups, number of PTA groups, number of school groups, number of health groups, number of cultural groups, number of political groups, number of youth groups, number of women groups, number of business association, number of saving associations, number of village associations and number of other associations), and infrastructural variables(dummy variable for access to fire station, worship center, dentist, midwife, primary health doctor, nursery school, primary school, and primary health clinic). The human capital theory supports the inclusion of years of schooling and education as an important factor that determines differences in earnings. Regional dummy variables are included to control for the effects of geography(Wan,2004).

Using equation (6) above, the log of consumption expenditure per adult equivalence log(y) for household i is estimated using the Ordinary Least Square (OLS) estimator as expressed in equation 7:

$$log(y_i) = \sum_{k=1}^{K} \hat{\beta}_k x_i^k + \hat{\epsilon}_i \tag{7}$$

Where $\hat{\beta}_k$ is the coefficient estimate and $\hat{\epsilon}_i$, the residual estimate for household i. Equation 7 is estimated separately for each of the four waves of the GHS representing the time periods: 2010/2011, 2012/2013, 2015/2016, and 2018/2019.

In the second stage of the analysis, the relative contributions of the regression estimates to overall inequality are accounted for through a decomposition process. Shares attributable to the characteristic/explanatory variable $k = 1, ..., K$ can be estimated for each year of the survey using equation (8) take the form:

$$s^k = \hat{\beta}_k \frac{\sum_{i=1}^{n} a_1(\mathbf{y}) x_i^k}{I(\mathbf{y})} \tag{8}$$

Where $a_1(\mathbf{y})$ is the weighting factor and $I(\mathbf{y})$ is any inequality index that can be written as a weighted sum of incomes/expenditures (Shorrocks, 1982) We estimate these contributions to inequality in Stata using the "ineqrbd" command which uses the coefficient of variation (CV) as its measure of inequality. In addition, we follow the fields (2003) methodology such that our decomposition is estimated using the predicted consumption expenditure $(\hat{y})$ versus the actual consumption expenditure (y).
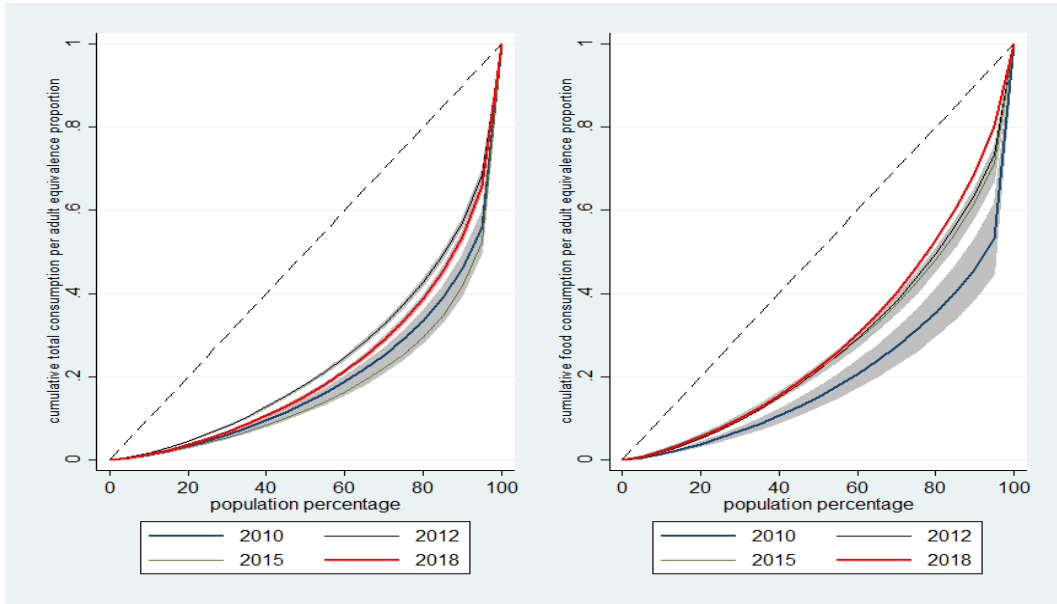
Figure 1: Lorenz Curves: TCEPAE and FCPAE Per Adult Equivalence 2010-2018

5 Results

Evolution of Inequality in Nigeria

The first question we address is focused on if inequality decreased between 2010 and 2018 in Nigeria. To answer this question we first construct Lorenz curves (Figure 1) using both Total Consumption Expenditure Per Adult Equivalence (TCEPAE) and Food Expenditure Per Adult Equivalence (FEPAE)[8] The results in Table 1 Panel A and Panel 3 provide estimates of inequality for Nigeria overall and across regions for the 4 survey periods. The national Gini coefficient confirms the inference of declining inequality between 2010 and 2018 highlighted in the Lorenz curves. Inequality as measured by the Gini decreased from 0.63 in 2010 to 0.50 in 2012 then increased significantly to 0.61 in 2015, then dropped to 0.54 by 2018. Comparing 2010 to 2018, inequality decreased by 13.5%. 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). Suggesting a downward bias in NBS estimates of inequality in 2018.[9]

To examine a potential channel for the decrease in inequality, we compute the changes in the median real TCEPAE and FEPAE over the period for Nigeria as a whole and across regions.[10] These results are summarised in Table 1 panels B and D. Median TCEPAE increased by about 6% from 2010 to 2018 but median FEPAE declined by 4.3%. The overall increase in real median TCEPAE is noteworthy and could be a channel through which inequality decreased. However, the decrease in median FCEPAE suggests that welfare may

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[8]Our main measure of inequality and discussion would be based on TCEPAE. However, we also present results using FEPAE for completeness.

[9]Our results using Gini based on FEPAE also suggests a substantial decline in inequality by ≈ 36% from 2010-2018. The high Gini for the South-Eastern region in 2010 stands out requiring further investigation.

[10]We do not compute the means and focus rather on the median given the data is not symmetrically distributed and contains extreme values.

not have increased for those below the median despite a decrease in FEPAE Gini.[11]

Typically, noting a decline in inequality and an increase in TCEPAE would be lauded as an indicator of economic progress but given the decrease in FEPAE amidst a significant increase in TCEPAE, it is necessary to consider alternative measures of inequality focused on the lower end of the distribution. Using consumption expenditures versus income, we estimate poverty incidence (P_0), poverty gap (P_1), and poverty severity (P_2) in each survey period. We subsequently compute the changes in these measures between 2010 and 2018.[12]

Table 1: Gini and Median Consumption Expenditures by regions and overall

| | 2010 | 2012 | 2015 | 2018 | 2010-2018(%) |
	(1)	(2)	(3)	(4)	(5)
Panel A	Gini using Total Consumption Expenditure per adult				equivalence
Nigeria	**0.63**	**0.50**	**0.61**	**0.54**	**-13.53**
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	0.80	0.50	0.59	0.49	-38.50
South South	0.60	0.47	0.55	0.50	-17.26
South West	0.50	0.49	0.62	0.50	-0.46
Panel B	Real Total Consumption Expenditure per adult				equivalence (naira)
Nigeria	**125702.6**	**94132.98**	**148610.2**	**133300**	**6.06**
North Central	126257.4	85279.73	148822.6	126344.8	0.07
North East	92403.56	59313.91	102581.6	83356.49	-9.79
North West	93436.59	69811.67	92292.66	99436.44	6.42
South East	140564.1	108632.9	179847.5	192397.7	36.88
South South	162545.9	132118.1	253746.9	197773.2	21.67
South West	174402	146241.9	235500.2	210310.9	20.59
Panel C	Gini using Food Consumption Expenditure per adult				equivalence
Nigeria	**0.63**	**0.41**	**0.43**	**0.40**	**-35.55**
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	0.89	0.34	0.32	0.39	-56.49
South South	0.38	0.46	0.38	0.36	-7.49
South West	0.37	0.33	0.55	0.34	-6.14
Panel D	Real Food Consumption Expenditure per adult				equivalence (naira)
Nigeria	**56891.26**	**46292.86**	**57080.54**	**54448.43**	**-4.29**
North Central	54933.34	42453.56	48151.47	44484.04	-19.02
North East	43549.1	30549.96	49027.81	37649.56	-13.55
North West	51775.38	43875.48	48728.04	42059.99	-18.76
South East	56837.39	49373.94	65553.95	79958.24	40.68
South South	70641.36	54419.2	86115.59	78732.92	11.45
South West	71027.27	53358.34	60764.78	72606.35	2.22
N	28375	30295	32917	33355	

Table 2 is a summary of poverty estimates for Nigeria as a whole and for each region. We calculate these poverty measures by identifying individuals with total consumption expenditure per adult equivalence below the poverty line. Poverty has increased significantly over the period. P_0 increased by 22.6 percentage points from 21.6% in 2010 to 44.2% in 2018. P_1 also increased by 10.3% points and poverty severity increased by 5.75% points.[13] The substantial increase in P_0 and falling FEPAE even as TCEPAE increased and inequality declined warrants further investigation.[14] A 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.

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[11]The trend in the TCEPAE is consistent with the trend in GDP per capita over the period. With increases in GDP per capita between 2010 and 2012 and a decline between 2015-2018.

[12]See Foster et al (1984) for more information on these poverty measures. 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.

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

[14]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 in the extended version of this paper.

Our second question is focused on testing for evidence of convergence in inequality across regions and figuring out if differences across regions in inequality contribute more to national inequality than within region differences. The Gini estimates by region are summarized in Table 1 Panels A and C. While real median TCEPAE and FCPAE estimates by region are summarized in Table 1 panels B and D.

Table 2: 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
N	28375	30295	32917	33355	

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 estimated Gini in each region in 2010 with their 2018 estimate. In particular, inequality declined in all regions but the North East experienced a 1.3% increase and also had the highest Gini 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.[15] Our results also provide evidence of convergence across regions in estimates of inequality using FEPAE. The variance across estimated Gini by region declined over time.

While within region Gini coefficients appear to be converging over time, our results suggest significant divergence across regions in both food and total consumption expenditures over time. Table 1 panels B and D provide evidence consistent with this trend. In 2010 the 3 southern regions had the highest median TCEPAE and these 3 regions had the highest growth in median TCEPAE between 2010 and 2018 (36.9%, 21.7%, and 20.56%). In contrast, average growth in TCEPAE was only 0.01% in the North Central region and 6.4% in the North West. TCEPAE shrunk in the North Eastern region by 9.8%. This decline in consumption in this region which has suffered significantly from armed conflict since 2009 is consistent with Odozi and Uwaifo Oyelere (2019) who provide evidence of the impact of conflict on welfare.

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

In terms of FEPAE, our results show that the overall decline of 4.3% by 2018 was driven solely by a decline in all the northern regions. FEPAE 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%).

In terms of the question of what contributes more to the national level of inequality, our estimations (table not included) suggest that regional differences contribute more than within-region differences in every survey year. In 2010 the Gini between regions contributed 41.3% to overall inequality and it 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 FEPAE 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 finding from Table A panels B and D suggest that while within region differences in consumption exist and policies aimed at attenuating these differences should be a priority, a more significant challenge is the growing disparities between northern and southern regions in consumption expenditures.

The significant disparities across the North and South regions are corroborated with the estimates of poverty by region, and the changes in poverty over time summarized in Table 2. In 2010 the Northern regions had higher levels of poverty and this trend persists in 2018. What is more concerning is that while P_0 has increased across all regions in Nigeria between 2010 and 2018, the increases in the southern regions are significantly smaller than in the northern regions. P_0 increased in the northern regions by approximately 35, 28, and 24 percentage points respectively. In contrast, P_0 increased by approximately 13, 9, and 4 percentage points respectively in southern 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 all the northern regions, (P_2) more than doubled while in the southern regions (P_2) increased but the change is much less. The divergence across the northern and southern regions in (P_0), (P_1) and (P_2) from 2010-2018 is consistent with the divergence across the northern and southern regions in TCEPAE and FEPAE. Further, the declining FEPAE in the northern regions could be a result of the significant increase in poverty in these regions.

Decomposition of Inequality by Expenditure Source

Next, 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 laid out in Lerman and Yitzhaki (1985). We implement this decomposition in Stata using a Distributive Analysis Stata Package (DASP) by Abdelkrim and Duclos (2007). Similar to the rest of our

Table 3: 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	0.434	0.627	0.249	0.397
	(0.028)	(0.040)	(0.036)	(0.046)
real nondurable expenditure per adult equivalent	0.115	0.605	0.057	0.091
	(0.006)	(0.005)	(0.003)	(0.007)
Real durable expenditure per adult equivalent	0.451	0.750	0.321	0.512
	(0.023)	(0.008)	(0.018)	(0.040)
Panel B		Year 2012		
Real food expenditure per adult equivalent	0.398	0.412	0.136	0.270
	(0.005)	(0.005)	(0.003)	(0.008)
real nondurable expenditure per adult equivalent	0.211	0.603	0.109	0.217
	(0.005)	(0.010)	(0.005)	(0.009)
Real durable expenditure per adult equivalent	0.391	0.717	0.258	0.513
	(0.007)	(0.007)	(0.008)	(0.012)
Panel C		Year 2015		
Real food expenditure per adult equivalent	0.249	0.425	0.081	0.133
	(0.005)	(0.012)	(0.005)	(0.008)
real nondurable expenditure per adult equivalent	0.126	0.619	0.068	0.112
	(0.004)	(0.015)	(0.005)	(0.007)
Real durable expenditure per adult equivalent	0.626	0.750	0.458	0.755
	(0.006)	(0.004)	(0.007)	(0.010)
Panel D		Year 2018		
Real food expenditure per adult equivalent	0.299	0.404	0.093	0.172
	(0.005)	(0.003)	(0.002)	(0.005)
real nondurable expenditure per adult equivalent	0.144	0.521	0.063	0.116
	(0.002)	(0.003)	(0.001)	(0.003)
Real durable expenditure per adult equivalent	0.557	0.721	0.386	0.712
	(0.006)	(0.006)	(0.008)	(0.007)

Standard error in parentheses.

paper, we use consumption instead of income for this analysis. Consumption expenditure can be divided into 3 main sources: food, non-durables, and durables. In column (1) of Table 3, the share of each expenditure source in TCEPAE (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 over Gini is summarized and in column (4) the relative contribution to overall inequality is presented. Each panel is a summary of a survey year.

The results show that a significant portion of inequality in TCEPAE 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 TCEPAE 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 (0.71). With respect to non-durable goods expenditure per adult equivalence, while its Gini is consistently the lowest among the expenditure sources, its relative contribution to inequality has increased. However, its relative contribution to inequality is lower or equal to its share in total expenditure. Inequality in food expenditure decreased as noted above and its relative contribution to inequality decreased over the period. We can infer from these results that the decrease in inequality by 2018 was driven primarily by a decrease in inequality in food expenditure.

Regression Based Decomposition of Inequality

Table 4 summarizes the OLS estimates from the regression-based decomposition. The estimates are presented for each survey year in columns 1, 2, 3, and 4 representing the time

periods: 2010/2011, 2012/2013, 2015/2016, and 2018/2019. From Table 4, a substantial number of included variables were statistically significant in explaining changes in consumption expenditure per adult equivalent across all the years. With exception of a few, a good number of the variables take on the expected signs[16]. Education, as measured by years of schooling, is positive and significantly related to the logarithm of consumption expenditure suggesting an increasing expenditure effect of years of education.

The urban regional sector is positively significant and the relationship is consistent across all the survey years. It has been documented that about 50% of Nigeria's population lives in urban areas and the estimate is expected to reach 67% by 2050 (United Nations, 2014; Fox et al.(2018)). Population growth in major cities is an important factor driving Nigeria's urbanization(Sackey et al., 2012). Following political agitation and the increased dependence on oil revenue by states, several urban centers have emerged as new state capitals. The developmental biases in favor of major cities in Nigeria have been discussed in several studies(Mabogunje 1977; Okafor 1985, Nwaka 2005; Afolayan et al. 2008). The contribution of urban sector growth to Changes in consumption expenditure inequality can be linked to the favorable incomes of poor households and migrants as a result of the concentration of industries and other higher labor productivity sectors. Although migrants from peripheral areas to urban centers might not necessarily benefit from quality urban opportunities, this flip side of the story reflects the extent of the net contribution of the urban sector location to changes in consumption expenditure. Studies examining Africa's structural change have alluded to a form of resource-driven structural transformation that is associated with poverty and more inequality than the growth of tradeable manufacturing and services(Gollin, Jedwab, and Vollrath, 2016; Rodrik, 2016, Jayne, Chamberlin, and Benfica, 2018),

Age shows a significant and negative effect on consumption expenditure as well as the Age squared suggesting a non-linear relationship between age and per capita expenditure. This is consistent with the life-cycle earnings hypothesis of the inverted-U shape relationship with age. Existing empirical studies also demonstrate the U-shaped relationship between age and welfare(Blanchflower Oswald, 2004, 2008). Household size shows a significant and negative effect on consumption expenditure and is consistent across the years. It meets apriori expectation in the sense that households of large size are expected to consume less because higher household size is often associated with families of lower income and socioeconomic status.

In Nigeria, households of smaller size and of higher socioeconomic status often have fewer children and are relatively better off in terms of the number of goods and services they are able to command compared to households with many children. Amarante(2017) documents

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[16]The variables with unexpected signs are male, exposure to shock in 2010, and recent conflict exposure in 2010 and 2015. These unexpected signs could be linked with multicollinearity or endogeneity.

a link between household size and fertility and argued that increasing the number of children in the household decreases per capita available income and indirectly affects adults´ decisions about labor market participation or hours of work and which has effects on consumption. Through the channel of poor human capital accumulation by children from poor households, consumption expenditure is also affected in the long run as their labor productivity and income growth are compromised.

From the regression, all the regional dummy variables had negative signs except for the south-south geopolitical zone with a positive sign reflecting locational effects that either increase or decrease consumption expenditure. Nigeria is delineated into six regions and a dummy variable for each region was included to estimate the influence on consumption expenditure relative to south Western geopolitical zone. The effect of the infrastructural dummy variables on consumption expenditure across the four survey years is mixed. The health infrastructural variables[17] had positive signs and indicates an increasing effect on consumption expenditure while other infrastructural variables had a negative sign. The stock of social capital at the community level also showed a mixed effect across the social capital items and across the four survey years.

Table 5 presents the relative contributions of the regression estimates to the overall inequality. These contributions are presented for each survey year in columns (1), (2), (3), and (4) representing the survey periods: 2010/2011, 2012/2013, 2015/2016, and 2018/2019. We find that in 2010, education and urban residence were the biggest contributors to inequality. We also note that regional differences contributed significantly to inequality corroborating our earlier finding of zonal differences being a more significant contributor to inequality in Nigeria than within region differences. The results from 2010 also suggest that the presence and magnitude of social capital captured by the number of political groups, women groups youth groups, savings groups, and PTA, all contribute to reducing inequality. In 2018, while education still has a significant role in increasing inequality, we note a significant decline in the contribution of education and urban residence to increasing inequality compared to 2010. This result suggests that the decrease in inequality between 2010 and 2018 noted from our earlier analysis could be driven by a decrease in education inequality in Nigeria. There is evidence of an increase in the number of people with access to education over time in Nigeria. In addition, the substantial decline in the contribution of urban residence to inequality could be a result of the increased urbanization in Nigeria and increased government initiatives set up to support rural households. For example, the National Social Safety Net Program was set up to address unemployment and improve the condition of living of the extremely poor and vulnerable Nigerians. Other programs supporting farmers include the Growth

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[17]access dummy to dentist, midwife, primary health doctor, nursery school, primary school, and primary health clinic

Enhancement Support Scheme(GES), and Agricultural Transformation Agenda(AGA), and the Central Bank of Nigeria Anchor Borrowers' scheme, initiated in 2011, 2012, and 2016 respectively. In 2018, the biggest contributor to increasing inequality is household size. The household size's contribution to inequality increased substantially between 2010 and 2018. Larger households tend to be poorer, with lower income leading to lower consumption per capita. Given the increasing importance of household size for inequality, programs targeted at larger households as well as culturally sensitive family planning initiatives could be possible effective short and longer-term solutions.

The results in 2018 compared to 2010 also suggests a decline in the disparities across regions in contributing to inequality. While regional differences still contribute to increases in inequality in 2018 this contribution has decreased. This finding corroborates our earlier finding of convergence across regions with respect to levels of inequality. Finally, the social capital-related variables on average contributed less to decreasing inequality in 2018 than in 2010. The contribution of certain variables to decreasing inequality declined while the contributions of other variables to increasing inequality accelerated. The general decline in the contributions of social capital variables in decreasing inequality in 2018 is worth further investigation given the change in political administration from 2014. Finally, it is important to note the increasing role of conflict in increasing inequality in Nigeria. The significant increase in violent conflict between 2010 and 2018 coincides with an increase in the contribution of conflict to inequality and provides suggestive evidence of the role of conflict in increasing inequality.

Table 4: Regression Based Decomposition: First Stage OLS Estimates

Y= Log Total Real Consumption Per Adult Equivalence	(1) 2010 b/se	(2) 2012 b/se	(3) 2015 b/se	(4) 2018 b/se
Years of School	0.031***	0.031***	0.040***	0.020***
	(0.002)	(0.002)	(0.002)	(0.001)
Age	-0.006***	-0.005***	-0.008***	-0.006***
	(0.002)	(0.002)	(0.001)	(0.001)
Age^2	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Urban=1 Rural=0	0.357***	0.438***	0.261***	0.094***
	(0.030)	(0.023)	(0.021)	(0.024)
Male	-0.052***	-0.061***	-0.081***	-0.022
	(0.018)	(0.017)	(0.014)	(0.015)
Household Size	-0.020***	-0.047***	-0.023***	-0.064***
	(0.003)	(0.003)	(0.002)	(0.002)
Exposure to Shock	0.048**	-0.085***	-0.027*	-0.085***
	(0.019)	(0.018)	(0.014)	(0.016)
Population density of a LGA	-0.000***	-0.000***	-0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Percent Recent Death/Population	3.092***	-1.564***	0.841***	-4.672***
	(0.626)	(0.488)	(0.147)	(0.378)
Rainfall	-0.000***	-0.000***	-0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
North central	-0.130***	-0.101***	-0.188***	-0.028
	(0.050)	(0.036)	(0.034)	(0.037)
North east	-0.398***	0.041	-0.340***	-0.319***
	(0.046)	(0.043)	(0.035)	(0.041)
North West	-0.439***	-0.279***	-0.329***	-0.236***
	(0.047)	(0.037)	(0.034)	(0.038)
South East	-0.020	0.111**	-0.093***	0.050
	(0.053)	(0.044)	(0.036)	(0.041)
South South	0.204***	0.177***	0.373***	0.171***
	(0.056)	(0.045)	(0.038)	(0.040)
Num. Disability Grps.	0.047**	0.041*	0.095***	-0.060***
	(0.019)	(0.025)	(0.023)	(0.017)
Num. Other groups	-0.010	0.177***	-0.042***	-0.029**
	(0.009)	(0.037)	(0.010)	(0.012)
Num. Vigilant Grps.	-0.045***	-0.040***	-0.007***	0.023***
	(0.014)	(0.011)	(0.003)	(0.009)
Num. of NGOS	0.189***	-0.042	0.135***	0.016**
	(0.018)	(0.027)	(0.028)	(0.007)
PTA groups	-0.021***	0.045***	0.001***	-0.000***
	(0.008)	(0.006)	(0.000)	(0.000)
Num. School Grps.	0.022**	-0.025*	0.047***	-0.004**
	(0.009)	(0.014)	(0.006)	(0.002)
Num. Health Grps.	0.008	0.050***	-0.006***	-0.019*
	(0.017)	(0.015)	(0.002)	(0.010)
Num. of cultural Grps	0.009	0.016	-0.002	-0.001
	(0.007)	(0.011)	(0.002)	(0.004)

Y= Log Total Real Consumption	(1)	(2)	(3)	(4)
Per Adult Equivalence	2010	2012	2015	2018
	b/se	b/se	b/se	b/se
Num. political Grps	-0.015***	-0.002	0.005	0.018***
	(0.003)	(0.003)	(0.006)	(0.004)
Num. youth Grps	-0.041***	-0.014	-0.002**	-0.002**
	(0.005)	(0.009)	(0.001)	(0.001)
Num. Women Grps.	-0.021***	0.028***	0.007***	-0.005***
	(0.004)	(0.005)	(0.002)	(0.001)
Num. Bus Assoc.	0.006***	-0.012**	0.001	0.008***
	(0.001)	(0.006)	(0.002)	(0.003)
Num. saving Coops.	-0.009***	0.000	-0.007***	-0.006***
	(0.003)	(0.005)	(0.003)	(0.002)
Num. Agric Coops.	0.005	-0.016*	-0.021***	0.003*
	(0.006)	(0.009)	(0.003)	(0.002)
Num. village Grps	-0.005	-0.009***	-0.001	0.018***
	(0.006)	(0.003)	(0.003)	(0.006)
Dummy firestation	-0.010	-0.173***	-0.015	0.160***
	(0.044)	(0.043)	(0.017)	(0.034)
Dummy Worship center	0.098***	-0.047*	0.090***	-0.058
	(0.035)	(0.026)	(0.023)	(0.037)
Dummy Dentist	0.202***	0.200***	0.040	0.105***
	(0.056)	(0.047)	(0.027)	(0.029)
Dummy Midwife	0.194***	-0.175***	0.016	-0.000
	(0.028)	(0.024)	(0.021)	(0.020)
Dummy pridoc	-0.071*	0.104***	0.086***	0.013
	(0.041)	(0.032)	(0.021)	(0.024)
Dummy nursery	0.149***	0.035	0.164***	0.163***
	(0.026)	(0.025)	(0.019)	(0.019)
Dummy primary school	0.159***	0.053*	0.118***	-0.137***
	(0.025)	(0.030)	(0.020)	(0.027)
dummy primary clinic	0.038	0.097***	0.023	0.163***
	(0.034)	(0.029)	(0.019)	(0.020)
Constant	12.172***	11.869***	11.903***	12.367***
	(0.068)	(0.057)	(0.047)	(0.065)
R^2	0.263	0.335	0.313	0.304
N	10446	9017	18511	17445

Table 4 Continuation

	(1)	(2)	(3)	(4)
Variables	2010	2012	2015	2018
yrsch	19.0451	20.6474	25.2703	11.4593
Age	-2.2541	-3.1758	-5.7741	-5.491
Age^2	2.3561	3.1797	7.4616	4.5334
Sector	20.5958	30.3083	13.8551	3.946
Male	0.1191	0.2197	0.3493	0.0117
HH size	4.3625	15.1605	6.7962	40.7127
Exp shock	-0.0536	2.3151	0.3408	0.8393
Pop density	-2.5086	-5.1827	-1.0825	2.3491
Recent Exposure to Conflict	0.5878	-0.0447	-0.2829	3.6499
Rainfall	0.8388	2.1294	-3.6939	-0.9965
North Central	-1.6532	-0.0495	0.826	-0.0383
North East	9.1691	-0.5591	7.1345	9.7006
North West	17.7572	12.4527	13.2956	7.5481
South East	-0.2637	1.1204	-0.6049	0.6493
South South	4.3002	3.2813	12.1207	3.2433
Num. disabled asscia Groups	-0.228	-0.01	0.125	0.809
Num. of others Groups	-0.0366	0.7868	-0.9022	-0.0723
Num. of Vigilante Groups	-0.318	0.1291	-0.31	0.0286
Num. of NGO Groups	10.8584	-0.462	2.019	-0.0301
Num. PTA Groups	-1.9642	5.2276	0.2507	-0.1041
Num. Schoocomm Groups	1.3398	-0.1554	2.343	-0.3578
Num. healthcomm	-0.0446	0.0509	0.087	0.0825
Num. cultural Groups	1.0874	0.8952	-0.1416	-0.081
Num. Politcal Groups	-2.6844	-0.2945	0.6552	1.9863
Num. youth Groups	-4.6634	0.0171	-0.1816	0.1093
Num. women Groups	-3.6049	2.9172	1.5443	-0.8593
Num. busassoc Groups	1.0569	-0.4423	0.1628	1.4174
Num. savingscoop Groups	-0.1134	0.0005	-0.8613	-0.5369
Num. agricoop Groups	-0.1092	0.5484	0.6923	-0.3542
Num. village asso Groups	-0.1672	-0.8797	-0.0787	0.7638
Access Firestation	-0.051	-0.0389	-0.4	0.8275
Access worshipcentr	-0.3429	-0.2058	1.9491	-0.0103
Access dentist	4.2287	2.4452	1.0536	0.7761
Access midwife Dum	10.108	-5.1063	0.6388	-0.0081
Access pri doctor	-2.239	4.5793	3.305	0.3623
Access nur	10.1487	2.0628	10.2723	6.5858
Access primary	3.7509	1.0307	1.4103	0.5521
Access primary clinic	1.5904	5.1013	0.3554	5.996
Total	100	100	100	100

Table 5: Contributions to Inequality

6 Summary, Conclusion and Policy Implications

In this paper, we focus on the evolution of inequality and consumption in Nigeria as a whole and across regions. Our period of analysis is from 2010 to 2018. First, we estimate inequality using Gini and evaluate its evolution over the period of analysis. Next, we consider if there is evidence of convergence across regions. Finally, we explore the contributors to inequality first with respect to expenditure sources, and subsequently with respect to explanatory variables.

Our results suggest a decline in inequality from 2010 to 2018, corroborating other earlier studies. We also find that despite the 6% increase in median TCEPAE, median FEPAE decreased by 4%. More concerning is the noted increase in poverty measures over this period. P_0 rose by 22.6 percentage points, P_1 increased by 10.3 percentage points and P_2 more than doubled. These results suggest that welfare for those at the lower end of the distribution has decreased over time which is consistent with the current sentiment of declining living standards in Nigeria. Our second question focused on investigating convergence across regions in simple measures of welfare. While we find evidence of convergence between 2010-2018 measured within region Gini, median consumption expenditures diverged across regions. Southern regions experienced much higher increases in expenditure than northern regions, further exacerbating differences in TCPEPAE noted in 2010.[18] We also note divergence across regions in poverty incidence, poverty gap, and poverty severity. Most of the increase in poverty incidence, severity, and the gap in Nigeria is driven by significant increases in the Northern regions. Finally, we find that durable goods expenditure contributes the most to inequality throughout the period. In addition, we find education and living in an urban area are significant contributors to inequality in each survey period. However, the role of these two factors declined over time.

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 the armed conflict appears to be one reason but others factors could matter. Second, what are the determinants of inequality across regions in Nigeria? While we are able to identify in this paper what is contributing to inequality in each survey year, identifying causal effects is important. 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. We address the question of what determines differences in inequality across Local government areas in future research.

Finally, it is important to highlight that our results provide a cautionary tale about the importance of looking at multiple indicators of welfare. Increases in median consumption

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[18]The only region with a decline in median TCEPAE by 2018 is the Northeast.

expenditures may not provide a robust picture of welfare improvement for a good proportion of households. Although the median person in Nigeria consumed more in real terms in 2018 than in 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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