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# Macroeconomic Determinants of Consumption Inequality in Nigeria: Does Agricultural Productivity Matter?

Oziengbe Scott Aigheyisi<sup>1</sup> and Presley Kehinde Osemwengie<sup>2</sup>

<sup>1</sup> Institute of Health Technology, UBTH, Benin City, Nigeria

<sup>2</sup> Department of Economics, University of Benin, Benin City, Nigeria

<sup>1</sup>oziengbeaigheyisi@gmail.com, <sup>2</sup>presley.osemwengie@uniben.edu

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**Abstract:** The paper examines the effect of agricultural productivity and other macroeconomic variables on consumption inequality in Nigeria. The ARDL approach to cointegration and error correction modeling was employed for the analysis. The study found that agricultural productivity and domestic investment reduce consumption inequality in the long run. FDI was also found to be associated with reduction in consumption inequality in the short run, but its long run effect was not statistically significant. Based on the evidence, the study recommends as measure to reduce consumption inequality in the country, increased investment in the agriculture sector to enhance its productivity, and improvement in the investment environment through infrastructural development, including energy, road, telecommunication infrastructure, favourable, tax policies, enhanced national security, etc. to encourage domestic investment and enhance the attractiveness of the economy to FDI.

**Keywords:** Consumption Inequality; Agricultural Productivity; Rich Households; Poor Households; ARDL; Nigeria

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## Introduction

Private consumption is a measure of level of welfare. According to Attanasio and Pistaferri (2016) and Meyer (2020), consumption is a more important factor than income in issues of welfare and inequality. However, inequality in the distribution of income has gained more attention than consumption inequality. Thus, the literature on income inequality is broader than that of consumption inequality.

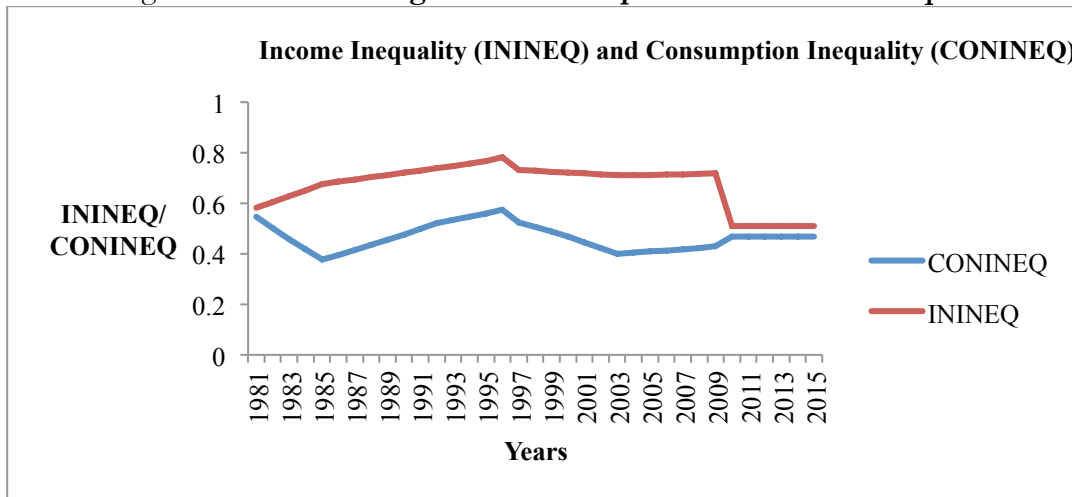
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<sup>1</sup> Corresponding Author

One of the problems of developing countries is low level of consumption per capita. There is also the problem of consumption inequality. The non-poor segments of societies have greater access to economic resources including food, accommodation, clean water, means of mobility etc. than the poor segment. Thus, consumption tends to be concentrated in the rich segment. High consumption inequality in developing countries is reflected in high poverty rates and malnutrition with its attendant adverse health effects.

In Nigeria, inequalities in consumption and income have been quite high, though income inequality has been higher than consumption inequality. This may be attributed to consumption smoothing by low income households achieved through savings, borrowing, remittances received and government transfers (Attanasio & Pistaferri, 2016; James, Palumbo & Thomoas, 2018). The trends in consumption and income inequalities show that between 1981 and 1985, both variables trended in opposite directions. Increase in income inequality was associated with decrease in consumption inequality. This may be attributed to consumption smoothing by low income households. However, from 1986 to 2007, both variables moved in same direction in the most part; increase (decrease) in consumption inequality was associated with increase (decrease) in income inequality. These suggest that there has been no clear-cut, consistent (stylized) relationship between income inequality and consumption inequality in the country.

Figure 1. Trends in Nigeria’s Consumption and Income Inequalities



Source: Data from the Global Consumption and Income Project (GCIP)

From our search of the literature, we found that quite a few studies have examined the macroeconomic determinants of consumption inequality especially in Nigeria. This study was motivated by this observed deficiency in the literature, and the fact that consumption inequality in some parts of the country is quite high, prompting the need to examine the factors affecting it. The study differs from other related studies and contributes to the extant literature by examining the effect of agriculture total factor productivity on consumption inequality in the country. This is in view of the fact that food consumption constitutes significant portion of total consumption in the country and agriculture (which is the main source of food) remains the base of the nation’s economy; at the same time it is the source of livelihood for most Nigerians, though low agricultural productivity adversely affects agriculture output (FAO, 2020).

## **Literature Review**

Ample studies exist on the macroeconomic determinants of private consumption. In the study conducted by Adedeji and Adegboye (2013) it was found that private consumption in Nigeria is positively affected by GDP per capita, disposable income, inflation, and old-age dependency ratio. It was also found that FDI, government spending and real effective exchange negatively affect aggregate consumption. Verter and Osakwe (2014) found that household consumption is positively and significantly affected by disposable income, but negatively and significantly affected by inflation and savings rate in Czech Republic. Varlamova and Larionova (2015) found that for OECD countries, household expenditure is positively and significantly affected by disposable income, consumer prices and education level, but negatively affected by interest rate, tax, government consumption spending and imports. Bonsu and Muzindutsi (2017) found that household consumption in Ghana is positively and significantly affected by price level and income (GDP) in the long run. The positive effect of price level on private consumption was attributed to inflation expectation which engenders increase in current consumption expenditure. Ikwuagwu, Ariwa, and Onyele (2017) found that government spending positively affects consumption expenditure, while interest rate negatively affects it in the long run in Nigeria. The study also found that short run causality runs from interest rate to consumption.

Whereas private consumption is affected by various macroeconomic variables as seen in the studies discussed in the preceding paragraph, there is however wide disparity in the distribution of consumption expenditure among households, especially in developing countries. Few studies have been conducted on the macroeconomic determinants of consumption inequality. Moreover, previous known related studies ignore (exclude) the potential roles of agricultural productivity in reducing consumption inequality in Nigeria. An investigation of the effect of agricultural productivity on consumption inequality in Nigeria is significant considering the role of agriculture in food production and in the nation's economy. Food insecurity, according to Akpalu, Christian and Codjoe (2018) constitutes a threat to subjective welfare, which has a strong linkage to consumption.

Agricultural production is dependent on the viability of a country's agricultural sector. The more viable the agricultural sector is, the higher the volume of agricultural output would be. The viability of a nation's agricultural sector depends largely on its productivity. All things being equal, the level of agricultural or food production varies directly with agricultural productivity. However, there has been unequal access to food and other resources in developing countries, resulting in high consumption inequality (Akpalu, *et al.*, 2018).

Several studies have attempted to examine the effect of agricultural productivity on consumption, welfare and poverty. Amare and Shiferaw (2017) found significant correlation between land productivity and consumption inequality in sub-Saharan Africa. Specifically, it found that increase in agricultural land productivity engendered increase in consumption inequality by 3% and 12% in Nigeria and Uganda respectively. This was attributed to the fact that agriculture practiced by large scale farmers is more productive than that practiced by small-scale, peasant farmers. The implication is that improvement in

agricultural productivity generally benefits the large scale mechanized farmers, leading to expansion in consumption inequality. The researchers advocated for support for small-scale farmers to access credit to boost their productivity. Their finding was consistent with that of the study by Amare *et al.* (2017) which also found that agricultural productivity negatively affects poor household in Nigeria, though it positively affects the growth of household consumption generally and the welfare of non-poor households. The implication of agricultural productivity effect of rainfall shock on household consumption in Nigeria was examined by Amare *et al.* (2018). The study found that negative shock to rainfall adversely affects agricultural productivity, and the decline in agricultural productivity decreases in household consumption.

The study by Dzanku (2015) on the effect of agricultural productivity on welfare and poverty in Ghana found that improvement in agricultural productivity is associated with improvement in welfare and reduction in poverty, though substantial improvement in agricultural productivity is required to achieve significant reduction in poverty levels. Cervantes-Godoy and Dewbre (2010) found that the poverty reducing effect of economic growth in developing countries was driven significantly by improvement in agriculture.

In many developing countries, food consumption constitutes major aspect of household (private) consumption (Dossche, *et al.*, 2018) and it has a strong linkage to welfare (Akpan *et al.*, 2013). Access to food and other resources such as cars, electricity, gasoline, and other forms of energy, healthcare services, education, etc. by individuals and households is determined by myriads of factors. This paper empirically examines the effect of improvement in agricultural productivity and other macroeconomic variables on consumption inequality in Nigeria. It is a novel study as no prior study to our knowledge based on a wide search of the literature has undertaken this task for the country. The paper is motivated by the need to reduce consumption gap in the economy by raising the consumption level of the poor, as huge consumption gap, could have serious adverse implication for economic development, considering that consumption is closely linked to welfare.

## **Methods**

### ***Model and Methodology***

Consumption inequality is affected by factors affecting consumption. Reducing consumption inequality entails increasing the level of consumption of the poor, reducing the level of consumption of the non-poor rich or both, though the first is more desirable for welfare or enhanced living standards and economic growth. Whereas consumption inequality may be affected by numerous factors, in this study, it is hypothesized that consumption inequality in Nigeria is dependent on agricultural productivity, and macroeconomic variables including FDI, domestic investment, price level and per capita income (measure of economic development). The model to examine the macroeconomic determinants of consumption inequality in Nigeria is specified functionally as:

$$\text{CONINQ} = f(\text{AGTFP}, \text{FDIY}, \text{GCFY}, \text{CPI}, \text{PCY}) \quad [1]$$

Where CONINQ = Consumption inequality. Consumption inequality was measured by the Atkinson's index which has been proven to be a more reliable index of inequality than

other indices (Atkinson, 2008) The index takes on values between 0 and 1, with higher values indicating higher inequality, and lower values indicating more equitable distribution of consumption or higher consumption equality (or lower inequality). AGTFP = Agricultural total factor productivity. For this we use the index of agricultural total factor productivity computed by the United States Department of Agriculture Economic Research Service (USDA) which takes all agricultural inputs including land, labour, machinery, fertilisers etc. into consideration. FDIY = net foreign direct investment as percentage of GDP, GCFY = Gross capital formation as percentage of GDP (proxy for domestic investment), CPI = consumer price index, PCY = Per capita income.

The ARDL approach to cointegration and error modeling developed by Pesaran, Shin and Smith (2001) is employed for the analysis. The approach involves OLS-estimation of an unrestricted error correction model (UECM) version of the ARDL model specified as:

$$\begin{aligned} \Delta\text{CONINQ}_t = & \beta_0 + \sum_{j=1}^p (\delta_{1j}\Delta\text{CONINQ}_{t-j}) + \sum_{j=0}^p (\delta_{2j}\Delta\text{AGTFP}_{t-j}) + \sum_{j=0}^p (\delta_{3j}\Delta\text{FDIY}_{t-j}) \\ & + \sum_{j=0}^p (\delta_{4j}\Delta\text{GCFY}_{t-j}) + \sum_{j=0}^p (\delta_{5j}\Delta\text{CPI}_{t-j}) + \sum_{j=0}^p (\delta_{6j}\Delta\text{Ln(PCY)}_{t-j}) \\ & + \beta_1\text{LAGTFP}_{t-1} + \beta_2\text{FDIY}_{t-1} + \beta_3\text{GCFY}_{t-1} + \beta_4\text{CPI}_{t-1} \\ & + \beta_5\text{Ln(PCY)}_{t-1} + \xi_t \quad [2] \end{aligned}$$

The variables are as previously defined. Ln stands for natural logarithm. Parameters  $\beta_1$  to  $\beta_5$  correspond to the long run relationship, while the parameters  $\delta_{1j} \dots \delta_{6j}$  correspond to the short run relationship.  $\Delta$  is the difference operator,  $\xi_t$  is the error term,  $j$  is the optimal lag order of the ARDL to be empirically determined. The joint significance of the regressors is tested using the computed Wald's F test. The null hypothesis of "no cointegration" ( $\beta_1 = \beta_2 = \beta_3 = \dots \beta_6 = 0$ ) is tested against the alternative hypothesis of cointegration ( $\beta_1 \neq \beta_2 \neq \beta_3 \neq \dots \beta_6 \neq 0$ ). Two sets of asymptotic critical values have been provided by Pesaran *et al.* (2001) for the F-statistic at different levels of statistical significance (1%-10%). One is the lower bound critical values which assume the variables are I(0), and the other is the upper bound critical value which assumes the variables are I(1). The decision rule is to reject the null hypothesis of no cointegration if the computed F-statistic is greater than the upper bound critical value at the chosen level of significance. The null hypothesis is accepted if the F-statistic is less than the lower bound critical value. No conclusion is drawn if the computed F-statistic is between the lower and upper bound critical values.

The short run (error correction) model is derived from the ARDL model (equation 2) as:

$$\begin{aligned} \Delta\text{CONINQ}_t = & \beta_0 + \sum_{j=1}^p (\theta_{1j} \Delta\text{CONINQ}_{t-j}) + \sum_{j=0}^p (\theta_{2j} \Delta\text{AGTFP}_{t-j}) + \sum_{j=0}^p (\theta_{3j} \Delta\text{FDIY}_{t-j}) \\ & + \sum_{j=0}^p (\theta_{4j} \Delta\text{GCFY}_{t-j}) + \sum_{j=0}^p (\theta_{5j} \Delta\text{CPI}_{t-j}) \\ & + \sum_{j=0}^p (\theta_{6j} \Delta\text{Ln}(\text{PCY}_{t-j})) + \eta\text{ECT}_{t-1} \\ & + \varepsilon_t \end{aligned} \quad [3]$$

$\theta$ s measure the respective short run effects of the explanatory variables on the dependent variable. ECT is the error correction term measuring the speed of adjustment to equilibrium in the event of short run deviation of the long run (equilibrium) relationship. To play the role of error correction, its coefficient  $\eta$  is expected to be negatively signed and statistically significant.  $\varepsilon$  is the error term.

The long run (static) equation is derived from the ARDL model as:

$$\text{CONINQ}_t = \alpha_0 + \alpha_1 \text{AGTFP}_t + \alpha_2 \text{FDIY}_t + \alpha_3 \text{GCFY}_t + \alpha_4 \text{CPI}_t + \alpha_5 \text{Ln}(\text{PCY}_t) + \mu_t \quad [4]$$

The  $\alpha$ s measure the long run effects of the respective explanatory variables on the dependent variable.  $\mu$  is the error term.

The *a priori* expectations are:  $\alpha_1 < 0, \alpha_2 < 0, \alpha_3 < 0, \alpha_4 < /> 0, \alpha_5 < 0$ . Since improvement in agricultural productivity is associated with improvement in agricultural output which constitutes significant portion of consumption, it is hypothesized that increase in agricultural productivity will engender education in consumption inequality in the long run. In growth theories, investment (comprising FDI and domestic investment) is predicted to engender increase in outcome. Where this leads to increase in output of household consumption goods, accompanied by enhanced access to say same, FDIY, GCFY will be negatively related to reduction in consumption inequality. All things being equal, in the absence of consumption smoothing, CPI is expected to adversely affect consumption level of (low-income) households, leading to increase in consumption inequality, contemporaneously. However, with inflation expectation and capacity for consumption smoothing, increase in CPI may lead to increase in consumption and reduction in consumption inequality. Following Gao and Zeng (2010), real GDP per capita which is a measure of level of economic development is hypothesized to suppress consumption inequality.

Prior to the estimations, the variables were tested for unit root using the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test.

**Data**

Annual time series data covering the period from 1981 to 2015 were used for the analysis. The data were sourced from the Global Consumption and Income Project, GCIP (2018) and the World Bank’s World Development Indicators, WDI (2018) and the USDA ERS (2019). Specifically, data on consumption inequality was obtained from GCIP, and data on

AGRTFP was obtained from the USDA ERS, while data on other variables were obtained from the WDI. The scope of the study (1981-2015) was dictated by data availability as the last data observation for consumption inequality from the source was for 2015.

## Findings

### *Results and Discussions*

The analysis begins with the KPSS unit root test for the variables. The results are presented in Table 1.

Table 1. **KPSS Unit Root Test**

Variables	Level KPSS test stat.	Critical Value (5%)	Inference	First Difference			I(d)
				ADF test stat.	Critical Value (5%)	Inference	
CONINQ	0.1151	0.1460	S	-	-	-	0
AGTFP	0.1609	0.1460	NS	0.1450	0.1460	S	1
FDIY	0.1740	0.4630	S	-	-	-	0
GCFY	0.1305	0.1460	S	-	-	-	0
CPI	0.2104	0.1460	NS	0.1366	0.1460	S	1
Ln(PCY)	0.2011	0.1460	NS	0.0961	0.1460	S	1

Source: Authors' Estimations using EVIEWS 9

The unit root test results indicate that the variables are of mixed order of integration. CONINQ, FDIY and GCFY are stationary at levels, while AGTFP, CPI and Ln(PCY) are stationary at first differences. However, there is the tendency for the variables to converge in the long run. The cointegration relationship was tested using the Bounds test approach. The result of the test is presented in Table 2.

Table 2. **ARDL Bounds Test**

Included observations: 33		
Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	K
F-statistic	12.26071	5
Critical Value Bounds		
Significance	I0 (Lower) Bound	I1 (Upper) Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Source: Author's Estimation using EVIEWS 9.

The computed F-statistic (12.26) is greater than the upper bound critical value at the 1% significant level. Thus, the null hypothesis that “no long-run relationships exist” is rejected. Since the variables are found to be cointegrated, the dynamic short run relationship can be represented with an error correction model. The result of estimation of the error correction model is presented in Table 3.

Table 3. **Error Correction Model**

<b>Dependent Variable: D(CONINQ)</b>			
<b>Variable</b>	<b>Coefficient</b>	<b>t-Statistic</b>	<b>Prob.</b>
D(AGTFP)	0.001542	2.456523	0.0258
D(AGTFP(-1))	0.002061	3.401549	0.0036
D(FDIY)	-0.001998	-0.657226	0.5204
D(FDIY(-1))	-0.009177	-3.413964	0.0036
D(GCFY)	0.000365	0.465395	0.6479
D(GCFY(-1))	0.001613	3.190497	0.0057
D(CPI)	0.000763	0.514673	0.6138
D(CPI(-1))	-0.003134	-2.080713	0.0539
DLOG(PCY)	-0.001492	-0.016158	0.9873
DLOG(PCY(-1))	-0.367177	-3.658307	0.0021
CointEq(-1)	-0.202134	-2.587440	0.0198

$R^2 = 0.976$ , Adj.  $R^2 = 0.951$ , F-stat. = 40.216, D. W. stat. = 2.040

Source: Author's Estimation using EVIEWS 9.

The estimated error correction model shows agricultural total factor productivity positively affects consumption inequality contemporaneously and with a lag in the short run. The effects are significant at the 5% and 1% level respectively, suggesting that improvement in agricultural productivity will widen the consumption gap in the country in the short run. Thus, large scale farmers with the capacity to take advantage of policies aimed at enhancing agricultural productivity tend to benefit more from the consumption effect of agricultural productivity than the small scale farmers which are in greater numbers in the country. This finding gives credence to the evidence from Amare and Shiferaw (2017) which also found that agricultural land productivity is positively related to consumption inequality. FDI is associated with significant suppression (with a lag) in consumption inequality. This suggests that inflow of FDI into the productive sectors of the economy will engender reduction in consumption inequality therein as a result of increase in output. Contrary to the reduction in consumption inequality by FDI, domestic fixed capital formation is found to be associated with increased consumption inequality in the country in the short run, with a lag.

Consumer price index is negatively and significantly related to consumption inequality in the short run. The decline in consumption inequality associated with increase in prices may be due to differences in consumption between the rich and the poor, and inflation expectation which create the tendency for low income households to increase their demand for consumption goods. The demand for consumption goods by high-income (non-poor) households or individuals may not be affected by inflation expectation as much as it is with low income individuals who may have to draw on their savings or transfers or remittances received to smooth their consumption (expenditure) and also store up consumption goods in anticipation for future rise in prices. Per capita income is negatively and significantly related to consumption inequality. This suggests that economic development will engender improvement in equitable distribution of consumption in the short run.



The error correction coefficient is negatively signed as expected, and it is also statistically significant at the 2.5% level. Thus, it will rightly act to play the role of error correction in the model. The negative and significant error correction coefficient further confirms existence of cointegration relationships among the variables, and its value implies that the speed of adjustment to equilibrium in the event of short run deviation therefrom is quite low, being 20.2%. The coefficient of determination ( $R^2$ ) implies that about 98% of the systematic variation in the dependent variable is explained by the model. The high explanatory power is further confirmed by the F-statistic of 40.26, which suggests that the regressors are jointly significant in the explaining in the dependent variable. The D.W. statistic points to absence of the problem of autocorrelation.

Whereas agricultural productivity as found to be positively related to consumption inequality in the short run, however, it is negatively related to it in the long run and the effect is significant at the 5% level (Table 4). Improvement in agricultural productivity will therefore enhance equitable distribution of consumption (that is reduction in consumption inequality) in the long run.

**Table 4. Long Run Model**

<b>Variable</b>	<b>Coefficient</b>	<b>t-Statistic</b>	<b>Prob.</b>
AGTFP	-0.006185	-2.133253	0.0487
FDIY	0.027729	1.236716	0.2340
GCFY	-0.014643	-1.933069	0.0711
CPI	-0.006686	-1.724675	0.1038
LOG(PCY)	1.096537	1.912925	0.0738
C	-6.310166	-1.732357	0.1024

Source: Author’s estimation using EViews 9.

The long run effects of FDI and price level on consumption inequality are statistically not significant. Domestic investment negatively affects consumption inequality in the long run and the effect is significant at the 10% level. Thus, it will reduce consumption inequality in the long run. The long run effect of per capita income on consumption inequality is positive and significant at the 10% level. This suggests that if income is not equitably distributed, economic development will engender greater consumption inequality in the long run.

**Diagnostic Tests**

The results of the diagnostic tests for reliability of the underlying ARDL model are summarized in Table 5.

**Table 5. Summary Diagnostic Tests**

Test	F-stat	p-value	Jarque-Bera stat	p-value
Normality test	-	-	0.0658	0.9676
Serial Correlation LM Test (Breusch-Godfrey)	0.5783	0.5737	-	-
Heteroskedasticity Test (Breusch-Pagan-Godfrey)	0.3976	0.9629	-	-
Functional Form (Ramsey RESET Test).	0.5880	0.4551	-	-

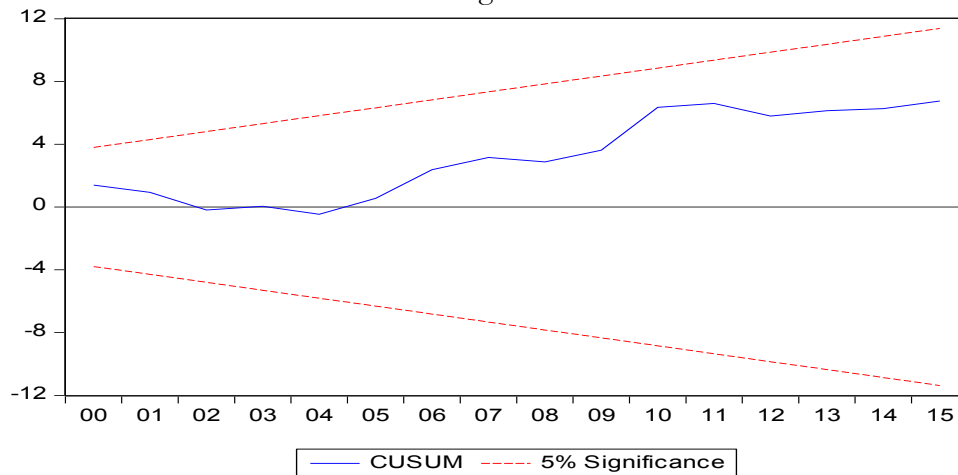
**Authors’ results using EViews 9.**

The normality test indicates that the residuals of the model are normally distributed, as the p-value of the Jarque-Bera statistic fails to reject the hypothesis of residual normality. There is absence of problem of serial correlation and heteroskedasticity as shown by the Breusch-Godfrey and Breusch-Pagan-Godfrey test respectively. The functional form of the model is appropriately specified as indicated by the Ramsey RESET test.

***Stability Test***

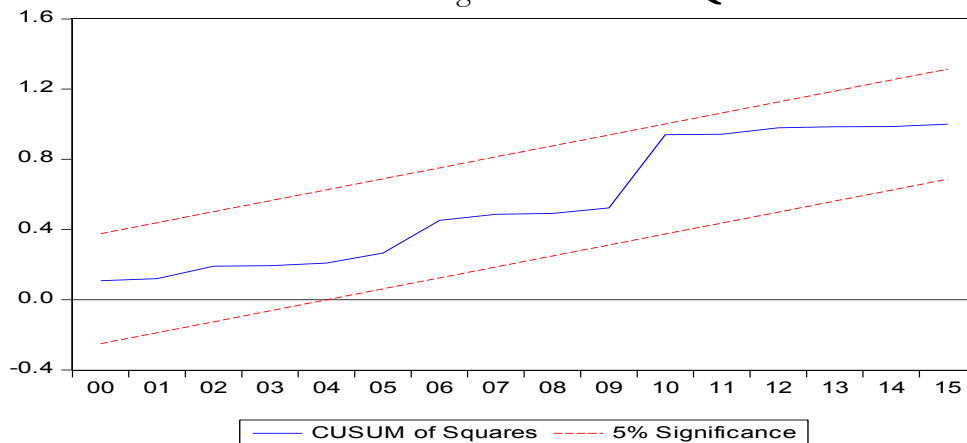
The approach to testing model stability prescribed by Brown, Durbin and Evans (1975) which involves plots of the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squared recursive residuals (CUSUMSQ) was employed to test the constancy of the estimated regression parameters. The results are shown in Fig 2a and Figure 2b.

Figure 2a. **CUSUM**



Source: Authors' output from EViews 9

Figure 2b. **CUSUMSQ**



Source: Authors' output from EViews 9

The CUSUM and CUSUMSQ plots lie between the 5% significance critical bounds. These imply that the model is structurally stable, and can be relied upon for policy.

## **Conclusion**

The paper examined the macroeconomic determinants of consumption inequality in Nigeria, with special focus on the effect of agricultural productivity. The ARDL approach to cointegration and error correction modeling was employed for the analysis. The study found that consumption inequality is widened by agricultural productivity in the short run, but suppressed by it in the long run. FDI and consumer price index were found to be inversely related to consumption inequality in the short run, though the long run relationships were not significant. The long run effect of domestic investment on consumption inequality was negative and significant. Whereas the short run relationship between per capita income and consumption inequality was found to be negative and significant in the short run, it turned out to be positive and significant in the long run.

Based on the empirical evidence, it is recommended that, to reduce consumption inequality in Nigeria, government should channel efforts towards; improving agricultural productivity through improved investment in the agricultural sector; encouraging domestic investment and making the economy more attractive to FDI through infrastructural development, including energy, telecommunication, and infrastructure, favourable, tax policies, enhanced national security, etc.

## **Bio**

Oziengbe Scott Aigheyisi (PhD) is currently a lecturer and senior procurement officer at the Institute of Health Technology, University of Benin Teaching Hospital, Benin City, Nigeria. His areas of interest are International Economics, Monetary Economics, Development Economics and Applied Econometrics.

Presley Kehinde Osemwengie (PhD) is currently a lecturer at the Department of Economics, University of Benin, Benin City, Nigeria. His areas of interest are Health Economics, International Economics and Econometrics.

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