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ABSTRACT

This paper investigates the effect of economic size and uncertainty on income inequality in Nigeria from 1980 to 2020. Using the ARDL methodology, and controlling for structural breaks, we investigate how economic size and uncertainty influence income inequality in Nigeria while controlling for the effects of government expenditure, oil rent, birth rate, and primary school enrollment rates. Results from the analysis shows that the short-run effects of economic size and uncertainty on income inequality is positive and insignificant. The effect in the long-run remains positive and insignificant for economic size, but negative and significant for uncertainty. The effects of other variables like government expenditure and birth rate are negative and statistically significant. The government of Nigeria need to treat the reduction of income inequality as a long-run phenomenon, but endeavour to reduce uncertainties in the short run which exacerbates income inequality.

Keywords: Economic size, uncertainty, income inequality, ARDL

JEL codes: D31, D63, E24, H24, O15

1. INTRODUCTION

Income inequality and the size of an economy are inextricably linked. Economic size and inequality present a paradox of some sort, inequality retards growth in poor countries but

encourages growth in rich countries (Barro, 2000). However, when economies are prospering, the workers are incentivized to work harder and entrepreneurs to invest more, provoking in turn more inequality (Mexico).

The Nigerian economy - which is the largest in Africa - recorded many years of sustained economic growth (until the recession of 2016 occasioned by falling oil prices of mid-2014 to 2016, (Husain, *et al*, 2015) and the 2020 COVID-19 induced recession). According to Ajakaiye, *et al* (2016), Nigeria has maintained remarkable growth over the last decade, recording an average growth rate of 6.8 per cent from a large economic base. Real gross domestic product (GDP) growth was estimated at 6.23 per cent in 2014 compared to 5.49 per cent in 2013. The rebasing of its GDP in April 2014 by the National Bureau of Statistics to better reflect the size and structure of the economy saw it surge past South Africa to become Africa's largest economy with a rebased GDP estimate of USD454 billion in 2012 and USD510 billion in 2013. The rebased GDP, using updated prices and improved methodology, also revealed a more diversified economy than previously thought. This expanding size of the economy seems to occur as inequality seems to be rising. The combined wealth of Nigeria's five richest men, could end extreme poverty at a national level, yet five million face hunger; the amount of money that the richest man can earn annually from his wealth is sufficient to lift two million people out of poverty for a year, the share of Nigerians living below the poverty line increased from 69 million in 2004 to 112 million in 2010, equivalent to 69% of the population. Rising inequality in Nigeria is a threat to the country's unity (Oxfam, 2017). Besides being a threat to the country's unity, rising inequality can have a devastating effect on the effort to fight poverty. Some of the states in Nigeria with the highest gini coefficient are also among the poorest (National Bureau of Statistics, 2019). The level of income inequality in the country can make it almost impossible to pull a sufficient number of people out of the poverty line. Currently, four out of ten Nigerians live below the poverty line, with most of these poor people lacking access to basic living conditions in the form of electricity, health and educational infrastructure (World Bank, 2022)

The phenomenon of the effect that growth exerts on inequality in Nigeria will be examined empirically with the view to understanding how the various spurts and slumps in growth caused by episodic disruptions to the structure of the economy impacts income inequality in Nigeria.

The incidence of rising inequality is occurring at a time Nigeria is going through uncertainties in its socio-economics. These uncertainties have both internal and external dimensions. For example, the war on insurgency (Boko Haram) and the bad state of insecurity are some of the internal dimensions of the uncertainties in the country, coupled with policy uncertainties. Externally, events such as the COVID-19 crisis and the ongoing Russia-Ukraine war have contributed to the level of uncertainty in the country. Under such conditions, higher income earners in the country may seek higher yielding assets (Kasa and Lei, 2018) especially in safe havens, thus increasing their capacity to keep earning higher income, and likely widen the income inequality gap.

Literature is replete with studies on how income inequality affects economic growth (see, Galor and Zeira (1993), Barro, 2000, Forbes, 2000; Mo, 2000). As far as we know, few studies have combined the possible impact of economic size and uncertainty on income inequality in Nigeria. Based on the foregoing, this paper seeks to estimate the effects of economic size and uncertainty on income inequality in Nigeria, in both the short run and long run.

The remainder of this paper is organized thus: section two presents the literature while section three the data used in analysis is described and methodology laid out. In section four, the result of empirical analysis is presented and discussed, while section five contains the conclusion of the study, including policy implications.

2. LITERATURE REVIEW

2.1 Theoretical literature

In his seminal work on economic growth and income inequality, Kuznets (1955) noted that rise in per capita income is initially accompanied by rise in inequality but as the gains of rising income go round, inequality will decrease. This point was however contested by Galor and Zeira (1993) who observed that countries with greater income per capita have a more equal distribution of income while countries with a more equal initial distribution of wealth grow more rapidly and have a higher income level in the long run. In Ehrhart (2009), the determinants of income inequality can be broadly divided into economic and politico-economic factors. The economic determinants of income inequality include factors such as presence of an imperfect capital market, rise in fertility rate, low domestic market. On the other hand, politico-economic

determinants of income inequality include redistributive tax pressure and the socio-political environment. The socio-political environment is one of the reasons for the inclusion of uncertainty as a determinant of inequality in our model. Other determinants of inequality include school attainment, which is expected to drive down inequality (Barro, 2000).

2.2 Empirical Literature

2.2.1 Economic size and income inequality

There have been various attempts at linking inequality with overall economic performance, whether as a cause (see, Momoh and Okwu, 2022) or a consequence (see Ogbeide-Osaretin and Efe, 2022)

The relationship between economic growth/economic size and income inequality has been investigated by studies such as German-Soto and Cantu (2015) who studied per capita product and income inequality in Mexico with structural changes. The study found causality running from per capita product to income inequality, and found a negative and significant overall effect. Interestingly, after accounting for the various regime shifts that occurred mainly in the 1980s, the connection between per capita product and income inequality was no longer meaningful. The authors concluded that the result seemed to be linked to the slow growth of the Mexican economy after these structural breaks, affecting, in turn, the reductions in income inequality. Other variants of this study include Tsakloglou (1990) who studied the impact of economic development on the income of the poor in a panel of 24 developing and 7 developed countries using the ordinary least square. Findings from the study showed that real per capita gross domestic product as a measure of economic development positively influenced income distribution measured in per capita terms.

In an investigation into economic growth and income inequality in Malaysia, Shari (2000) observed that policies implemented to aid economic growth had a major impact on income inequality but also noted that government policy reversals towards liberalization, deregulation and privatization since the late 1980s has contributed to increasing inequality. On the other hand, the Chinese economy which is not so liberalized and heavily regulated does not have as much inequality as other East Asian countries. The study by Sato and Fukushige (2012) concluded that first, China's per capita GDP lowered income inequality in the ASEAN nations (including

China), until about 1997, after which the effect weakened. On the other hand, however, China's economic growth has dampened increased domestic income inequality

Lee (2015) investigated the relationship between economic growth and income inequality in a cross-section of 50 countries using the ordinary least square and found that GDP was not a significant explanatory variable for the gini coefficient (the proxy for income inequality). The study however attributed the insignificance of GDP as an explanatory variable of inequality to its weakness as a measure of economic growth. A similar study by Rubin and Segal (2015) examined how income inequality is affected by economic growth in the US. Findings from the study shows that economic growth is positively related to income inequality. That is, the higher the economic growth, the higher the income inequality (of the top income group)**.** The findings in the state of Alaska in the US by Kozminski and Baek (2017) confirms that of Rubin and Segal (2015), that is, the larger the economic size, the worse the income inequality, in both the short and long run. In Nigeria, Nwosa (2019) concludes that economic growth in is positively, but not significantly related to income inequality.

2.2.2 Effect of Uncertainty on Income Inequality

The effect of various kinds of uncertainties has been considered in several studies. For example, Mobosi and Madueme (2016) finds that various macroeconomic uncertainties exert significant negative effect on foreign investment. Political uncertainties are also a hinderance to sound economic performance (Ozekhome, 2017). This study is however concentrated on the effect on inequality that uncertainty has.

The relationship between uncertainty and income inequality has been tested empirically by studies like Fawaz, *et al* (2012) where the effect of uncertainty on income inequality in developing countries was estimated. Adopting the fixed effects and GMM estimation procedures, the study finds that uncertainty deepens income inequality in developing countries. The same outcome was arrived at by Brueckner and Vespignani (2017) whose study on the effect of trade uncertainty on income inequality using the OLS estimation procedure concluded that rising uncertainty leads to rising income inequality. Similarly, Theophilopoulou (2022) examined the role of macroeconomic uncertainties in explaining inequality in the United Kingdom. Using structural vector autoregressive (SVAR) method, findings from the study suggests that income

inequality is made worse by macroeconomic uncertainties. In a slightly similar paper, Kasa and Lei (2018) find that world uncertainty induces greater wealth inequality in the United States. Furthermore, Aye, et al (2019) concludes that in the presence of uncertainty, the influence of fiscal and monetary policies on income inequality is weakened.

So far, we find that income inequality worsens in the presence of uncertainty, even if Fischer *et al* (2019) explored the response of income inequality in various regions in the United States to economic policy uncertainty to show that income inequality responds heterogeneously to uncertainty. While in some regions, uncertainty led to decline in income inequality, in other regions, it exorbitated it. The study by Thye, *et al* (2021) further confirms that income inequality is not favourably affected by uncertainty. The study examined the effect of external and internal uncertainties in ASEAN-5 countries using the ARDL estimation method. Findings from the study shows that in the long run, external uncertainty drove inequality higher than country-level uncertainty.

One of the few studies that have attempted to estimate the effect of uncertainty (in this case, the effect of both domestic and external influences) on inequality in Nigeria is Nwosa (2020). The study concludes that globalization and economic growth negatively and significantly determine income inequality in Nigeria.

From the foregoing empirical review, it is evident that the effect on income inequality, of both economic size and uncertainty have not been explored in a study on Nigeria. Hence, the contribution of this study is three-pronged. Firstly, it combines the effects of economic size and uncertainty on income inequality in Nigeria. Secondly, the study explores the short-run and long-run effects of both economic size and uncertainty on income inequality using the ARDL estimation method. Thirdly, the study controls for the effects of structural breaks in the economic size, uncertainty-income inequality nexus, which prevents bias in parameter estimates.

3.0 DATA AND METHODOLOGY

3.1 Data description

The data for this analysis is yearly data that spans from 1980 to 2020. Data on birth rate (br), oil rent (oir), and primary school enrollment rate (pse) are all sourced from the World Development

Indicators (WDI) while data on real gross domestic product (RGDP) and oil rent (oir) are sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin. Data on income inequality – gini coefficient – is sourced from Standardized World Income Inequality Database (SWIID) based on Solt (2020), and the data on uncertainty (unc) is sourced from FRED database on https://fred.stlouisfed.org/series/WUIMANGA

A summary of the data used for this study is presented in table 1a. The table contains the various measures for each variable used in the study in addition to the variables' descriptive statistics. From the descriptive statistics, it is observed that all the variables follow the normally distribution as evidenced from the Jarque-Bera test of normality. The standard deviation of each of the series shows high degree of fluctuation of each of the series around its mean value.

On the other hand, the result in table 1b presents evidence that the combination of all the variables (especially the independent variables) will not lead to the problem of multicollinearity.

Table 1a: Descriptive statistics

Variables	Measurements	Mean	Standard Deviation	Minimum	Maximum	J-B	J-B (probability)	Obs.	Break date
Income inequality	Gini coefficient (disposable), which is arrived at after post-tax or post-transfer	43.12000	0.353700	42.20000	43.70000	1.413800	0.493171	30	2010
Economic size	The log of gross domestic product in 2010 prices, measured in billion naira	36318.43	17885.43	17170.08	70536.35	3.495291	0.174184	30	2001
Government expenditure	The log of government expenditure measured in billion naira	1925.076	2172.685	13.04110	7813.741	5.251028	0.072403	30	2018
Oil rent	Oil rent, as a percentage of GDP. Oil rent is oil revenue minus production cost	13.59959	5.285920	2.800011	26.42849	0.185752	0.911307	30	2013
Birth rate	Birth rate, measured as birth per woman	6.110633	0.347659	5.387000	6.698000	0.771530	0.679930	30	2009
Primary school enrollment rate	Primary school enrollment rate as a percentage of total enrollment	91.76987	6.602132	78.66348	106.2830	0.731116	0.693810	30	1991
Uncertainty	World uncertainty index for Nigeria	0.084136	0.057354	0.006556	0.223346	2.616896	0.270239	30	2000

Note: Obs. – observation. J-B - Jarque-Berra

Source: Author's computation.

Table 1b: Correlation Matrix

	inq	Lrgdp	Lgex	oir	br	pse	lwui
inq	1.000000						
lrgdp	0.101503	1.000000					
lgex	0.330526	0.189391	1.000000				
oir	0.479238	0.243789	0.066508	1.000000			
br	-0.483176	0.257018	-0.549423	-0.145568	1.000000		
pse	0.087188	-0.364866	0.250732	-0.020343	-0.378580	1.000000	
lwui	0.451303	0.367115	-0.003812	0.394061	0.221350	-0.425536	1.000000

Source: Author's computation.

3.2 Model and empirical methodology

Following the seminal work of Kuznets (1955) where per capita income is associated to initial rise in income inequality and its later fall as the gains of a growing economy spreads, this study relates economic size to income inequality. However, the model of Kuznets (1955) (which also includes the role of birth rate) will be augmented with the uncertainty, which forms part of the politico-economic factors recognized in Ehrhart (2009).

Thus, to examine the effect of economic size and uncertainty on income inequality in Nigeria, we specify a model as follows:

$$inq_t = f(ecz_t, unc_t) \quad (1)$$

Apart from the theoretical justification for the inclusion of economic size and uncertainty in the model for this study, it is in line with the empirical work of Barro (2000) and Thye, et al (2021) respectively. Other control variables introduced in this study as important determinants of inequality are included in accordance with Nademi (2018) (for the role of oil rent), Alamanda (2020) (for the role of government expenditure) and Arshed *et al* (2018) (for the role of primary school enrollment which is also observed by Asogwa (2019)). Thus, we extend the functional relationship in equation 1 to become:

$$inq_t = f(ecz_t, unc_t, gex_t, oir_t, br_t, pse_t) \quad (2)$$

In an estimable equation form, the functional relation in equation 2 is expressed thus:

$$inq_t = \delta_0 + \delta\, ecz_t + \delta_2 unc_t + \delta_3 gex_t + \delta_4 oir_t + \delta_5 br_t + \delta_6 pse_t + \mu_t \quad (3)$$

We will estimate equation 3 using the ARDL estimation technique developed by Pesaran *et al*., (2001). The ARDL estimation method is has the capacity to yield short run and long run consistent parameter estimates which can be achieved whether the independent variables are stationary at level ($I(0)$) or after first differencing ($I(1)$) (Pesaran and Shin,1995) Equation 3 in an ARDL form is:

$$\Delta inq_t = \delta_0 + \sum_{i=1}^{p} \delta_{1i} \Delta inq_{t-i} + \sum_{i=0}^{q} \delta_{2i} \Delta ecz_{t-i} + \sum_{i=0}^{r} \delta_{3i} \Delta unc_{t-i} + \sum_{i=0}^{s} \delta_{4i} \Delta gex_{t-i} + \sum_{i=0}^{t} \delta_{5i} \Delta oir_{t-i}$$
$$+ \sum_{i=0}^{t} \delta_{6i} \Delta br_{t-i} + \sum_{i=0}^{t} \delta_{7i} \Delta pse_{t-i}$$
$$+ \varphi_1 inq_{t-1} + \varphi_2 ecz_{t-1} + \varphi_3 unc_{t-1} + \varphi_4 gex_{t-1} + \varphi_5 oir_{t-1} + \varphi_6 br_{t-1} + \varphi_7 pse_{t-1} + \varepsilon_t \quad (4)$$

Where:

$-\frac{\delta_0}{\varphi_1}, -\frac{\varphi_2}{\varphi_1}, -\frac{\varphi_3}{\varphi_1}, -\frac{\varphi_4}{\varphi_1}, -\frac{\varphi_5}{\varphi_1}, -\frac{\varphi_6}{\varphi_1}$, and $-\frac{\varphi_7}{\varphi_1}$ are the intercept long-run coefficients and slope respectively, while δ_{1i}, δ_{2i}, δ_{3i}, δ_{4i}, δ_{5i}, δ_{6i}, δ_{7i} are short-run coefficients. p, q, r, s and t are the optimal lags on the first-differenced variables selected by the Akaike Information Criterion (AIC). In Pesaran *et al*., (2001), a long-run relationship is tested using the Wald (F-statistic) test, with two critical bounds values computed for any significance: the lower and upper bounds. If the calculated F-statistics is greater than the upper bound, there is cointegration or long-run relationship, otherwise, none exists. The relationship is inconclusive if the value of the F-statistic is between the upper and lower bounds.

The speed of adjustment into the long-run among inequality, economic size and uncertainty is given in an error correction model specified thus:

$$\Delta inq_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta ecz_{t-i} + \sum_{i=0}^{q} \beta_i \Delta unc_{t-i} + \sum_{i=0}^{r} \delta_i \Delta gex_{t-i}$$
$$+ \sum_{i=0}^{s} \chi_i \Delta oir_{t-i} + \sum_{i=0}^{t} \phi_i \Delta br_{t-i} + \sum_{i=0}^{u} \phi_i \Delta pse_{t-i} + ecm_{t-1} + \nu_t \quad (5)$$

3.2.1 Accounting for structural breaks in series

The paper controls for structural breaks. Understanding how income inequality responds to changes in the structure of the economy within the period under review, will ensure reliability of the parameter estimates. Thus, this study will account for the structural changes in economic growth series as measured by per capita product. Not controlling for structural breaks could bias the regression results. Thus, to account for these structural breaks, we adopt a three-step method, following Salisu and Obiora (2021). First, we use the ADF method to determine the break dates. This test produces the break date for each of the series under consideration. Secondly, we regress each of the variables against a dummy variable constructed for the break period. In essence:

$$y_t = \vartheta + \sum_{j=1}^{N} \iota_j D_{jt} + \mu_t$$

Where y is the series to be break-adjusted; D_j is 1 for each j, and zero otherwise. Thirdly, we determine the break adjusted series, estimated as $y_t^d = y_t - \sum_{j=1}^{N} \hat{\iota}_j D_{jt}$. The ARDL model is thereafter estimated using the break-adjusted series.

4.0 RESULTS AND DISCUSSION

4.1 Unit Root tests

In Table 2, we have the unit root tests reported for each of the series in the study. Both the Augmented Dickey-Fuller (ADF) and the Perron (PP) tests are considered. Results from both tests confirm that the variables are either integrated of order zero or one. That is, some of the variables become stationary (have no unit root) after first differencing, that is *I*(1), while the others are stationary at level, that is *I*(0). This makes it possible for the estimation to be done

with the use of the ARDL estimation technique, which allows for a mix of both *I*(0) and *I*(1) variables.

Table 2: ADF and PP unit root tests

	Level			**First Difference**			
	None	**Constant**	**Constant and Trend**	**None**	**Constant**	**Constant and Trend**	**Decision**
Gini	-1.8125*	-1.7428	-2.3930	-2.1005**	-2.0189	-3.1038	*I(1)*
br	-2.2493**	2.9109	-0.7448	-0.2856	-2.9684**	-4.5047***	*I(0)*
Gex	0.4962	-1.5538	-0.3393	-0.5887	-2.0121	-7.8408***	*I(1)*
rgdp	3.0591	-1.0412	-1.7682	-2.2692**	-3.7831***	-3.5655**	*I(1)*
lwui	-1.9482*	-3.0158**	-3.5874**	-6.7938***	-6.8423***	-6.8124***	*I(0)*
oir	-0.6691	-2.0331	-2.0788	-7.6147***	-7.5017***	-7.5279***	*I(1)*
pse	-1.4564	-2.3842	-2.4500	-2.9988***	-3.0769**	-3.0228	*I(1)*
PP							
Gini	-2.1182**	-2.1133	-2.0226	-1.9269*	-1.7817	-3.0460	*I(0)*
Br	-6.3214***	2.9109	-0.6728	0.7455	-1.5664	-1.7780	*I(0)*
Gex	3.1653	-1.5538	-0.7592	-4.9124***	-7.4042***	-7.7304***	*I(1)*
rgdp	3.0273	-1.0412	-3.0347	-2.6193**	-3.7831***	-3.3619*	*I(1)*
lwui	-2.3210**	-3.0158**	-3.5775**	-7.3591***	-9.0167***	-11.2804***	*I(0)*
oir	-1.9101*	-2.0331	-4.0523**	-11.9466***	-11.6753***	-23.4218***	*I(0)*
pse	-0.7201	-2.3842	-1.6755	-2.9988***	-3.0847**	-2.9626	*I(1)*

Source: Authors' computation

4.2 Bounds test of cointegration

Table 3 presents the result of the bounds test of cointegration. From the result, it is observed that the calculated F-statistics is greater than the upper or lower critical bound values at all 1% level of significance. This suggests that all the variables in this study have long-run relationship. Thus, both short run and long run parameters can be estimated for the coefficients in the ARDL model.

Table 3: Bounds test of cointegration

Estimated Model	**F-Statistics** 15.62956	
Critical Values (%)	**Lower Bound**	**Upper Bound**
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

Source: Authors' computation

The short run and long run estimations are displayed in Table 4. In the short-run analysis, we find that all coefficients, apart from birth rate, are positively related to income inequality. This implies that inequality increases with increases in economic size, government expenditure, oil rent, primary school enrollment and uncertainty; while it declines with more birth rates, all in the short-run. However, it is further observed that none of the short-run coefficients is significant at the 5% significance level. This implies that income inequality is not an economic phenomenon that can be addressed in a haste. Policies and programs geared towards reducing inequality in Nigeria have to be far reaching so they can endure.

Table 4: Short-run and long-run regression estimates of economic size, uncertainty and income inequality in Nigeria.

Variables	**Dependent Variables:**
	Inequality
Short-run estimates	
ΔEconomic size	0.0628
	(0.0496)
	[1.2628]
ΔGovernment expenditure	0.0363
	(0.0439)
	[0.8277]
ΔOil rent	0.0003
	(0.0021)
	[0.1191]

ΔBirth rate	-0.0517
	(0.0630)
	[-0.8201]
ΔPrimary school enrollment rate	0.019
	(0.0019)
	[0.9703]
Δuncertainty	0.0246
	(0.0156)
	[1.5749]
ect	-0.2639***
	(0.0582)
	[-4.5364]
Long-run estimates	
Economic size	0.2379
	(0.1804)
	[1.3186]
Government expenditure	-0.1152***
	(0.0381)
	[-3.0248]
Oil rent	0.0010
	(0.0080)
	[0.1188]
Birth rate	-1.0354***
	(0.1796)
	[-5.7654]
Primary school enrollment rate	-0.0013
	(0.057)
	[-0.2208]
Uncertainty	0.2472***
	(0.0458)
	[5.3937]
Constant	5.9403**
	(2.0602)
	[2.8834]

Adjusted R-squared	0.99
F-Statistics	130.8127
Prob.(F-stat)	(0.000)
Post estimation	
Breusch-Godfrey Serial Correlation LM Test	
F-stat	0.2124
Breusch-Pagan-Godfrey Heteroskedasticity Test	
F-stat	0.9842
Jarque-Berra Normality test	
p-value	0.4133

Note: Standard errors and t-statistics are in parentheses () and square bracket [] respectively; ***, ** and * represent significance at 1%, 5% and 10% respectively.

Source: Authors' computation.

The long-run estimates presented in the table shows a significant difference in outcome from the short-run analysis. From the estimates, economic size remains positive and statistically not significant. On the other hand, uncertainty is seen to be positively related to income inequality. By implication, the higher the uncertainty, the more the income inequality in Nigeria will be. This long-run findings are similar to that of Brueckner and Vespignani (2017) who found that trade uncertainty exacerbated income inequality. It is also similar to the findings of Kasa and Lei (2018). where uncertainty increases wealth inequality in the United States. Additionally, our findings agree with Aye, *et al* (2019) where US uncertainty worsens the effect of fiscal and monetary policies on income inequality and Thye, *et al* (2021). It is possible that uncertainty in Nigeria drives investment abroad by the more wealth, and reduces the capacity of the domestic economy to accumulate capital, which in turn leads to low productivity and low income (especially for those who were already in the low-income cadre). The income gap becomes wider when those who have the capacity to invest in safer assets abroad jeep receiving income significantly higher than the lower income earners in the country. Conversely, the result does not conform with that of Theophilopoulou (2021) where positive shocks to macroeconomic uncertainty lead to decreased income inequality in the United Kingdom. In our study, the relationship between uncertainty and income inequality is statistically significant at the 1% level.

The effect of economic size on income inequality in the long-run is similar to that of the short-run. The relationship is positive, that is, larger economic size leads to more income inequality. This long-run relationship is however not statistically significant. This result is similar to that of German-Soto and Cantu (2015) who found that after controlling for the various structural breaks in Mexico, the effect of economic size/growth on income inequality becomes negligible. In Lee (2015), the size of the economy is not found to be a significant explainer of income inequality, the same conclusion is found in Nwosa (2019).

Government expenditure in the long-run, against short-run estimates, significantly reduces income inequality in Nigeria. This is finding is in line with that of Alamanda (2020) where it was found that government spending in infrastructure in Indonesia reduced income inequality. Government spending in Nigeria helps to raise productivity which in turn reduces income inequality.

Other control variables in the long-run estimates show varying signs and significance. For oil rent, results indicate that it follows the short-run estimates. Oil rent is shown to be positively and insignificantly related to income inequality. On the other hand, birth rate is found to be negatively related to income inequality. That is, the higher the birth rate in Nigeria, the lower the income inequality. This relationship is statistically significant at the 1% level. Finally, the relationship between primary school enrollment rate and income inequality is negative, but not statistically significant. This implies that primary school enrollment rate reduces income inequality in Nigeria, but insignificantly.

The sign on the error correction term coefficient (ect_{t-1}) is negative and less than one. Furthermore, it is significant at the 1% level. This lends credence to the long-run relationship among the variables which was established with the Bounds test. The ect_{t-1} value of -0.2639 suggests that on the average, about 26.4% of deviations from the equilibrium will be corrected in the following year. This further suggests that it will take approximately about four years to restore the long-run equilibrium.

4.3 Diagnostic tests

The diagnostic tests are presented in Table 4. The Breusch-Godfrey serial correlation LM test, Breusch-Pagan-Godfrey heteroskedasticity test and Jarque-Berra Normality test all show that the residual of the ARDL model is not serially correlated, heteroscedastic, and is normally distributed. Furthermore, the CUSUM test presented in Figure 1 shows that the estimated ARDL model is stable as the CUSUM lines fall within the boundaries.

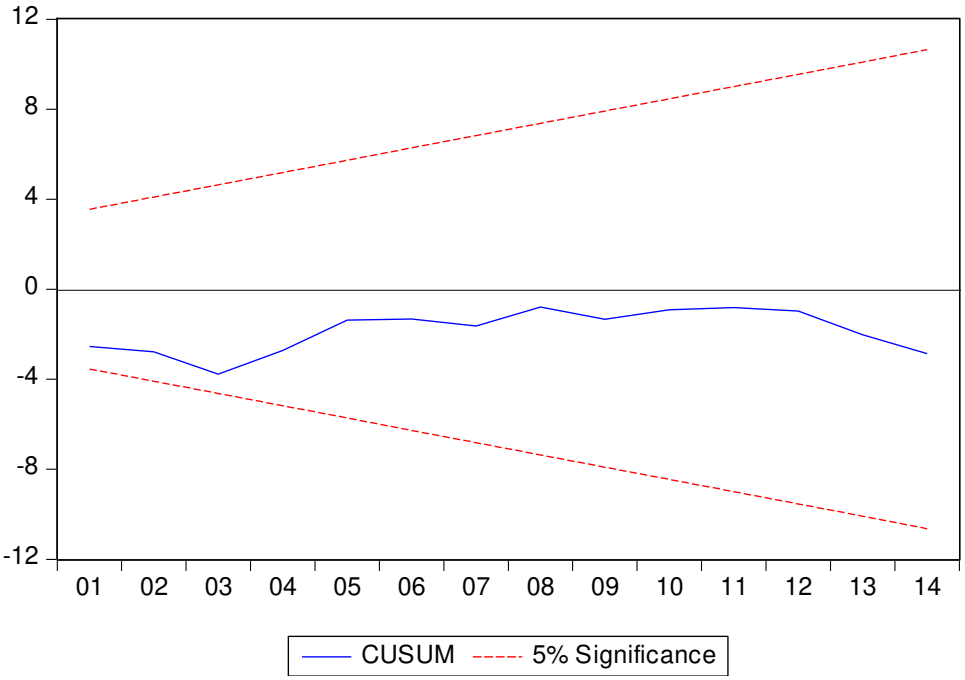

Figure 1: CUSUM long-run stability test.

5.0 CONCLUSION

Nigeria is Africa's largest economy. It is equally one of the countries in Africa with pronounced political, economic and social uncertainties. These factors have been theoretically found to affect income inequality (see Ehrhart, 2009).

Studies in the past on inequality in Nigeria have been focused on the effect of factors such as economic size and education. This study is the first to include uncertainty as having a possible effect on income inequality in Nigeria. Thus, extending studies in Nigeria such as Nwosa (2020). Findings from the study show that economic size and uncertainty both have positive, but insignificant effect on income inequality. On the other hand, the long-run estimates indicates that

while the effect of economic size remains positive and statistically not significant, the effect of uncertainty is also positive, and statistically significant. Other factors such as government expenditure and birth rates have negative and statistically significant effects on income inequality.

The policy implications of this study are as follows:

1. The effect of economic size and uncertainty on income inequality is a long-run one, hence, policies aimed at reducing income inequality have to be long-run in nature.
2. The government must endeavour to reduce various forms of uncertainties in the economy in order to reduce income inequality in the long-run. These uncertainties in the political, social and economic areas of life have very negative effect on those whose income are low and have little options to improve income in the presence of such uncertainties.
3. Government in Nigeria must increase its spending, especially in areas with the most potential for income inequality reduction. Finally, while uncontrolled rise in birth rate may not be encouraged, a rise in birth rate tends to encourage more labour productivity, thus reducing income inequality.

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