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HUMAN CAPITAL INVESTMENTS AND INCOME INEQUALITY IN NIGERIA: DOES INSTITUTIONAL QUALITY MATTER?

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Abstract

The study examines the impact of human capital and institutional quality on income inequality from 1990 to 2021. This study adopts the Kuznets model as its theoretical framework. The unit root test revealed a mixed stationary in the variables which prompts the choice of Autoregressive Distributed Lag of which its bound test result shows that there is a cointegration in the variables. The long-run results show that government expenditure on education, government expenditure on health, government effectiveness, and domestic credit to the private sector have a positive but not significant effect on income inequality while in the short-run, government effectiveness and domestic credit to the private sector have a positive but not significant impact on income inequality. Moreover, only government expenditure on education affects income inequality in the Nigerian economy positively and significantly. Based on the findings revealed, the study recommends that the government should by all means and economic resources increase the budget of human capital to enhance the reduction of income inequality in the country and place more emphasis on providing education grants and incentives that encourage the reduction of brain drain.

Key words:

Human capital investment, income inequality, institutional quality, Kuznets model, ARDL.

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1. Introduction

Nigeria is rich in renewable natural resources capable of achieving appreciable levels of economic growth and development. These natural resources have not been properly harnessed and proficiently driven by policies to attain substantial economic output (Raggl, 2017). The inability of these economic policies to transform these resources into wealth has resulted in having essential services such as education, healthcare, and transportation being underfunded. Similarly, agriculture, which employs a significant portion of the workforce, suffers from inadequate infrastructure, limited access to financing, and obsolete farming techniques, impeding its ability to change into a more lucrative sector (Ezeudu & Fadeyi, 2024).

Diversifying the Nigerian economy beyond oil is fundamental, with a need to invest in other sectors such as education, health, agriculture, mining, and manufacturing. Access to education is expected to enhance the technological advancement needed to propel the economy. But the investment in human capitals in Nigeria is very low compared to the standards of its proportional share to health and education. These investments are meant to reduce the disparity between income inequalities. The uneven distribution of educational resources and healthcare facilities has created a significant gap between the wealthy and the poor (Mohammed, Usman, Kojoli, & Ikeh, 2024). The affluent, often residing in urban areas, have access to better schools, higher-quality medical services, and supplementary learning opportunities, such as private tutoring and extracurricular activities (Olusegun, Joseph, & Carol, 2023). In contrast, many individuals in rural or underserved regions face inadequate educational infrastructure, poorly trained teachers, and limited access to basic healthcare services. This disparity results in a cycle of poverty, where the lack of investment in human capital restricts economic mobility and causes income inequality across generations (Adeleye, Bengana, Boukhelkhal, Shafq, & Abdulkareem, 2022).

By enhancing the skills, productivity, and general well-being of individuals, such human capital investments can lead to enhanced employment opportunities and higher wages to close the gap between income inequality in Nigeria. However, the unequal access to quality education and healthcare services in Nigeria exacerbates income inequality. Those who can afford better education and healthcare are more likely to secure high-paying jobs, while those from poorer backgrounds remain trapped in low-wage employment due to their lack of access to similar opportunities. This disparity and low investments in Nigeria's human capital perpetuates a cycle of poverty and hinders socio-economic mobility. Income inequality in Nigeria requires a concerted effort to enhance human capital investment across all socio-economic strata. Institutional qualities aimed at improving the quality and accessibility of public education and healthcare are essential (Kunawotor, Bokpin, & Barnor, 2020). This includes increasing government funding, ensuring equitable distribution of resources, and implementing targeted programs to support disadvantaged groups. By leveling the playing field, Nigeria can foster a more inclusive economy where individuals from all backgrounds have the opportunity to develop their potential and contribute to economic growth. This approach not only reduces income inequality but also promotes sustainable development and social cohesion (Mykhailenko, Havrylchenko, Bezkorovaina, Gliebova, & Kovalova, 2024).

Therefore, the effectiveness of human capital investment in reducing income inequality largely depends on the quality of the institutions that govern and implement these investments. High-quality institutions are characterized by good governance, strong rule of law, and efficient public services. Moreover, institutions play a key role in creating equitable access to educational opportunities (Adeleye, 2024). In Nigeria, where disparities in education are prevalent, strong institutional frameworks can advance inclusive policies that target marginalized and inaccessible communities. This includes implementing scholarship programs, improving infrastructure in rural areas, and providing incentives for teachers to work in disadvantaged regions. By lessening the structural barriers to education, institutions can help bridge the gap between different socio-

economic groups, enabling more individuals to acquire the skills needed to compete on the job market, thus reducing income inequality (Ajayi & Udeh, 2024).

In light of all said above, this paper considers the need to improve human capital investment to reduce income inequality through the mediating roles of institutional quality likewise serving as source of literature in Nigeria. This would also bridge the gap between the rich and the poor, create opportunities for individuals to contribute to the growth and development of the country, and advance improvement in technological advancement for productivity. A vacuum exists in the empirical link on the magnitude of human capital investment in lessening income inequality through the quality of institutions in Nigeria within the context of development. Therefore, this study provides vital information to the government and policymakers on how income inequality can be minimized and improves human capital investment in Nigeria. To do this, the paper tests the hypothesis that human capital investment in Nigeria does not significantly impact income inequality through the mediating roles of institutional quality. The rest of the paper follows accordingly while Section 2 focuses on the literature review; Section 3 presents the theoretical framework, model specification and empirical analysis of results and Section 4 presents the conclusion and recommendations.

2. Literature Review

Existing empirical literature on the study has shown various findings based on the selection of various variables on human capital and institutional quality that affect income inequality. For example, in the study of Fakthong (2012), the convergence of income disparity and economic growth was examined using two political regimes where one is solely education subsidies and the second is with investments in both education and research and development between 2000 and 2009 at the province level in Thailand. The study postulates that investments in research and development, and education may have greater worldwide implications, causing impoverished dynasties to flourish more quickly. The study's model simulations demonstrated that augmenting education subsidies with research and development expenditures improves the convergence in income and sustains long-term economic growth.

In Pakistan, Chani, Jan, Pervaiz, and Chaudhary (2014) investigated the causal relationship between economic disparity and inequality in human capital from 1973 to 2009. The study revealed that two inequalities have a positive long-term association. Subsequently, the study proposed that human capital inequality is a result of income inequality rather than the reverse. Following these findings, policy actions aimed at reducing income inequality may facilitate people's access to chances for skill development and the accumulation of human capital through educational services. Jiaju Yu and Ye Xu (2023) investigated the relationship in China between the distribution of human capital and income inequality. In the study, income disparity is divided into two categories; intersectoral and intergenerational. According to the study, there are three ways that income disparity influences the distribution of human capital in a region. First is adversely, second is favorably, and last through the interaction of intersectoral and intergenerational income inequality. Intergenerational income inequality's effect is contingent upon the extent of intersectoral income disparity, but the net impact of intersectoral income inequality is consistently negative. Based on these results, the study revealed that the best way to allocate human capital is through regional, long-term, phased policy formulation.

In Africa, between 1996 to 2018, Ouedraogo, Tabi, Ondoa, and Jiya (2022) investigated how institutional quality affects the development of human capital in 49 African nations using a dynamic model. The study then found that there exists an increasing institutional quality that improves access to education, especially for women. Also, effective government, prevention of corruption, political stability, and the lack of violence, including terrorism, are important factors that promote the development of human capital. Hence, to advance Africa's development of human capital, the reduction of these institutional economic proxies is needed. However, scarce extant literature has not assessed to investigate the mediating effects or impact of human capital, institutional quality, and income inequality in Nigeria. However, Ayoade, Orisadare, Adediwura, and Ofino (2023) investigated the impact of institutional quality and human capital development on poverty levels

in Nigeria from 1981 to 2020. The study found a positive relationship between institutional quality and poverty levels in the short and long run. However, when institutional quality was interacted with other human capital development components, no significant effects were observed. Physical capital also contributes positively to economic growth in Nigeria. The study then suggests that education and health human capital development can mitigate poverty levels, but these effects have not yet been fully realized.

The West African region, despite significant economic growth in the past two decades, the study of Kouadio and Gakpa (2022) revealed that there are still high levels of inequality and poverty within the region. The study further revealed that economic growth is necessary for poverty reduction, and improving institutional quality, including democratic institutions, bureaucratic constraints, judicial and regulatory systems, corruption control, and government stability, significantly reduces poverty and income inequality in the long run. Adeleye *et al.* (2022) explored the impact of human capital on population-economic growth in the Middle East and North America (MENA) countries, focusing on education enrollment and life expectancy. Using the mixed interaction effect, the study found that population growth and human capital indicators affect economic growth positively. The study reveals that population growth and human capital positively impact economic growth, with primary education being the most significant factor, using least squares and panel-corrected standard errors. Specifically, the results showed that population growth and human capital positively impact economic growth, with primary education having the most significant impact.

Equally, Ilori (2020) examined the impact of financial sector development on poverty reduction in Nigeria using the Johansen cointegration test to examine the existence of long run relationship among the variables. Results show a positive relationship between financial sector development and human development index, with aggregate credit positively correlated. However, the aggregate deposit is negatively related, suggesting low deposit mobilization by Nigerian deposit money banks. Ali (2022) employed the Autoregressive Distributed Lag (ARDL) bound test and Error Correction Model (ECM) to estimate the relationship between variables in Nigeria. The short-run results of human capital to government spending was positive at 5%, but the long-term relationship between human capital development, poverty, and income inequality in Nigeria is negative. The ECM has a weak adjustment rate of 1.2%, and a 1% significance correction is made annually. The study recommends increasing budget allocations for education and health, and improving living standards through empowerment and self-employment skills.

Lawanson, and Umar (2021) investigated the relationship between life expectancy and economic growth in Nigeria, focusing on the role of poverty reduction. The study then found that health positively impacts economic growth and mitigates the negative impact of poverty and that a minimum health improvement threshold of 64.4 years is a benchmark for health improvement, indicating that policies aiming to achieve this threshold are crucial for sustainable economic growth and significant poverty reduction in Nigeria. Sharimakin, Oseni, and Adegboye (2015) investigated the impact of education and labour productivity on income inequality in Nigeria using a dynamic structure, ARDL-bound cointegration, and error correction methodology. Results from the study revealed that labour productivity has a stronger impact on inequality reduction than education. Therefore, the study recommended that policies promoting education without labor productivity will not lead to inequality reduction in Nigeria. Sequel to this, the study suggests that sustainable income inequality reduction policies should incorporate productivity growth measures.

Selem-Amachree, and Ezekwe (2021) examined the impact of capital expenditure on income inequality in Nigeria from 1981 to 2019, using the ARDL model. Results show that community and social services have a significant negative effect on income inequality, suggesting the need for investment in education and health. Also, for economic services, such as agriculture, road, construction, and telecommunication have a negative impact. Sequel to these findings, public expenditure on administration is not significant in explaining income inequality changes. To this end, the study recommends prioritizing investments in critical social and economic infrastructures. In 2019, Chude, Chude, Anah, and Chukwunulu explored the relationship between government

expenditure, economic growth, and poverty reduction in Nigeria. The study found that government spending boosts economic growth by increasing private investment and fixed capital accumulation, reducing the current account deficit, external debt burden, and improving education and skills. However, it also highlighted that government expenditure has a short-term impact on poverty reduction, suggesting the need for extended fiscal policies to ensure high-quality private investment.

Obayori (2020) investigated the relationship between financial inclusion and economic growth in Nigeria from 1981-2018, finding that access to and effective use of financial services significantly boosts growth. However, per capita income negatively impacts growth. The study recommends extending financial inclusion services to rural communities, increasing financial literacy, and engaging low-income individuals in formal financial services. Fagbemi, Oladejo, and Adeosun (2020) explored the link between institutional quality and poverty in Nigeria, revealing that poor governance can increase poverty rates. It emphasizes the importance of democratic accountability and rule of law for poverty reduction. The study further highlighted the interconnectedness of poverty and weak institutions, suggesting that policymakers should focus on effective governance, addressing socio-economic inequalities, curbing political unrest, and building strong institutions.

3. Material and Methods

3.1. Theoretical Framework

In view of reducing income inequality in Nigeria, the Kuznets model is found instrumental for increase in the investments of human capital as an integral aspect of economic growth. The emergence of the Kuznets (1955) theory which is hinged on the assumption that an increase in economic growth leads to a sustained decrease in the rate of income inequality. Therefore, to reduce income inequality and poverty, there is a need for economic growth, and to improve economic growth, redistributive measures should be used to ensure equitable investment in human capital among different demographic groups. Kuznets further argued that economic growth is key to income inequality but the influence of political change cannot be overemphasized due to the fact that the choice of economic mechanism is not only scientifically determined but politically motivated over a period of time. This informs the theoretical framework of the study, and its linear function is expressed in [1] as follows,

$$INCEQ = f\ (EG, POLM) \quad [1]$$

where $INCEQ$ is income inequality, EG is economic growth, and $POLM$ is the political influence of the government when making economic policies.

3.2. Model Specification

The study is then based upon the assumption that human capital as an integral part of economic growth as argued by Kuznets (1955).

$$EG = f\ (HC) \quad [2]$$

Therefore, the study further expands the works of Ali (2022) and Adeleye *et al*. (2022) on the assumption that human capital and government effectiveness influences income inequality, and by inserting [2] into [1], the study's model specification is expressed in [3] having a control variable of domestic credit to private sector as,

$$INCEQ_t = f\ (GEDU_t, GHE_t, GOVEFF_t,\ DCP_t) \quad [3]$$

Where $INCEQ_t$= Income inequality proxy by percentile of income inequality at bottom 50% shares, sourced from the 2022 UNU-WIDER; $GEDU_t$= government expenditure on education, sourced from the 2022 Central Bank of Nigeria Statistical Bulletin; GHE_t= government expenditure on health, sourced from the 2022 Central Bank of Nigeria Statistical Bulletin; $GOVEFF_t$= Institutional quality proxy by percentage share of estimates of government effectiveness, sourced from the 2022 World Development Indicators, while DCP_t= Domestic credit to the private sector (% of GDP), sourced from the 2022 World Development Indicators. Although, it should be noted that to perform the unit root test and to determine the effect, the series must be

measured in the same units of measurements. This averts the log of some variables in order to certify the measurement of the series. Thus, the study's econometric model is then specified in [4] from the linear functional form as specified in [3]. This estimates also surfaces as the long-run results.

$$INCEQ_t = \beta_0 + \beta_1 LGEDU_t + \beta_2 LGHE_t + \beta_3 GOVEFF_t + \beta_4 DCP_t + \rho_t \quad [4]$$

The increase in government expenditure on education, health, and the proper effectiveness of the government policies are expected to reduce income inequality, while the lack of adequate accessibility and/or efficient access to financial credits by individuals increases income inequality in Nigeria. To this end, the short-run econometric estimates is expressed in [5] as,

$$\Delta INCEQ_t = \beta_0 + \sum_{i=1}^{p} \gamma_{1i} \Delta INCEQ_{t-i} + \sum_{j=1}^{q_1} \gamma_{2j} \Delta LGEDU_{t-j} + \sum_{j=1}^{q_2} \gamma_{3j} \Delta LGHE_{t-j} + \sum_{j=1}^{q_3} \gamma_{4j} \Delta GOVEFF_{t-j} + \sum_{j=1}^{q_4} \gamma_{5j} \Delta DCP_{t-j} + \varphi ECT_t + \rho_t \quad [5]$$

Where $\gamma_1 - \gamma_5$ are the vector parameters of the long-run estimates, Δ are the operators of the first difference, $\delta_1 - \delta_5$ are the vector parameters of the short-run estimates, p and $q_1 - q_4$ are the optimal lag length, β_0 is the parameter of the drift component, and ρ_t is the stochastic white noise.

4. Analysis of Results

4.1. Trend Analysis

Figure 1 depicts the trend of human capital, institutional quality, and income inequality in Nigeria between 1990 to 2021 revealing that between 1990 and 1993, Nigeria experienced a reduction in income inequality and maintained a persisting rate below the public investments in human capital. Although the trend showed that the Nigerian government experienced a reduction in the investments of human capital between 1990 and 1992 the income inequality of the country suffered a surge during the period. This showed that the implemented nation's economic policies such as the Structural Adjustment Programs (SAP) could have influenced these decreasing derivatives in the trend.

This followed an increase in the share of the recurrent public expenditures on education and health to boost labour productivity and eradicate poverty through the reduction of income inequality in Nigeria. With institutional quality serving as a mediating measure for sustainable policies to augment this change, the Nigerian government's effectiveness tends to decrease on an annual basis from 1990 to 2021 which shows how weak the effectiveness of the country's decisions.

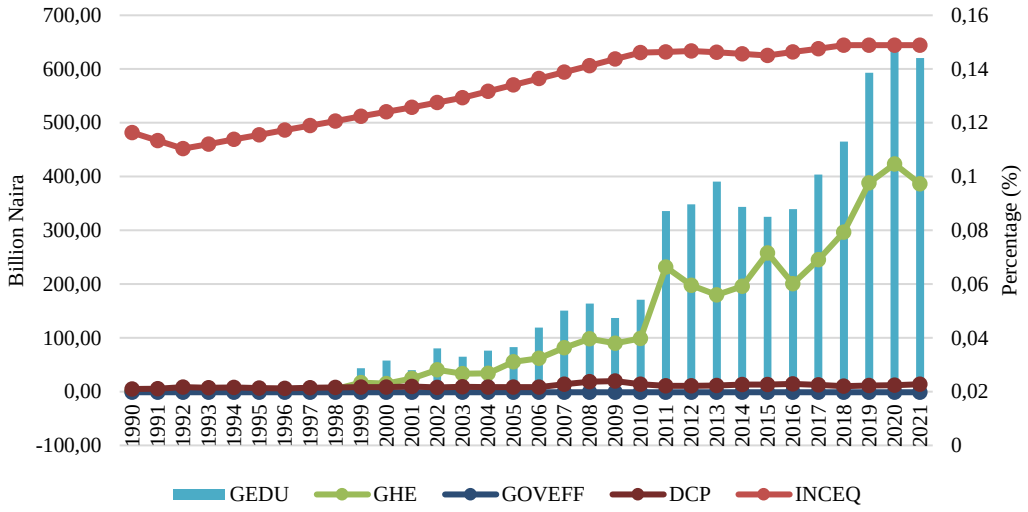


Fig.1: Trend of Human Capital Investments, Institutional Quality, and Income Inequality in Nigeria
Source: Authors' compilation using Excel 2016.

4.2. Descriptive Statistics and Correlation Matrix

Table 1 presents the dataset's descriptive statistics and correlation matrix ranging between 1990 and 2021. It was revealed that the mean values of the dataset lie within its minimum and maximum values and that the standard deviation for income inequality, and government expenditures on education and health are close to the mean values respectively while government effectiveness and domestic credit to private sector far from the mean values. As such, income inequality, and government effectiveness are negatively skewed towards normality while government expenditures on education and health and domestic credit to the private sector are positively skewed towards normality. Although, despite the positive and negative skewness of the data series, all the datasets except domestic credit to the private sector were platykurtic.

Also, Table 1 revealed that domestic credit to the private sector and government expenditures on education and health have a very high and positive correlation on income inequality at 75.3, 93.5, and 95.2 respectively. Government effectiveness has a relatively high but negative correlation with income inequality at 61.9 in Nigeria between 1990 and 2021.

Table 1

Descriptive Statistics and Correlation Matrix

Variables	$INCEQ_t$	$GEDU_t$	GHE_t	$GOVEFF_t$	DCP_t
Mean	0.133113	189.7057	114.9371	-1.016062	10.27442
Max.	0.148900	646.7475	423.3298	-0.901513	19.62560
Min.	0.110400	0.291298	0.150161	-1.204817	4.957522
Std. Dev.	0.013707	200.9563	129.6805	0.094393	3.539942
Skewness	-0.270269	0.917140	1.007920	-0.621714	0.821189
Kurtosis	1.497860	2.624049	2.829316	2.062090	3.352764
Obs.	32	32	32	32	32
Variables	$INCEQ_t$	$LGEDU_t$	$LGHE_t$	$GOVEFF_t$	DCP_t
$INCEQ_t$	1.0000 [---]				
$LGEDU_t$	0.9353** [14.4803]	1.0000 [---]			
$LGHE_t$	0.9521**	0.9924*	1.0000		

	[17.0629]	[44.3490]	[---]		
$GOVEFF_t$	-0.6194** [-4.3217]	-0.5658** [-3.7589]	-0.5739** [-3.8385]	1.0000 [---]	
DCP_t	0.7534** [6.2773]	0.6589** [4.7972]	0.6911** [5.2370]	-0.5877** [-3.9786]	1.0000 [---]

Source: Authors' Computation using Eviews 10.

4.3. Unit Root Test

Thus, having determined the extent to which the variables behave and how related they are to each other, then, it is important to test for the stationarity of the variables. However, before determining the stationarity of the variables through the unit root test, the optimal lag length among the datasets is important. The optimal lag length criteria help avoid the estimation problem, especially to prevent misspecification of variables, serial correlation, and multicollinearity. Therefore, to determine this, the rule of thumb states that the lowest criterion is the best-selected criterion at its corresponding lag length. As such, Table 2 revealed that using the Vector Autoregressive (VAR) optimal lag length criteria, it was discovered that the maximum lag length to be used in determining the unit root test is 2 and the selected criteria is the Akaike Info Criterion (AIC).

Thus, the implication is that to conduct a unit root test for the study, it is worth relying on AIC to proceed at lag 2. As such, the study adopts the AIC lag length for its unit root test and model estimation, as shown in Table 2. The study analyses the time series characteristics of each variable in the model to establish their stationary qualities. It is critical to do this test to evaluate the status of stationarity of the variables since conducting regression analysis on non-stationary data might result in a faulty regression.

Table 2

VAR optimal lag length criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	87.77020	NA	2.76e-09	-5.518013	-5.284481	-5.443304
1	188.6657	161.4327	1.80e-11	-10.57771	-9.176513*	-10.12946
2	228.6376	50.63111*	7.73e-12*	-11.57584*	-9.006978	-10.75404*

Source: Authors' Computation using Eviews 10.

Table 3

Unit root test results

Test Type	Level		First Difference		Order
	Constant	Constant & Trend	Constant	Constant & Trend	
$INCEQ_t$					
ADF	-2.1337 [-2.9639]	-1.2431 [-3.5683]	-3.3518 [-2.9639]*	-3.4995 [-3.5683]**	I(1)
PP	-0.5290 [-2.9604]	-1.6801 [-3.5628]	-3.3523 [-2.9639]*	-3.6697 [-3.5683]*	I(1)
$LGEDU_t$					
ADF	-5.8537 [-2.9677]*	-5.7049 [-3.5742]*	-	-	I(0)
PP	-1.4126 [-2.9604]	-3.0373 [-3.5628]	-9.3892 [-2.9639]*	-26.4591 [-3.5683]*	I(1)
$LGHE_t$					
ADF	-4.9419 [-2.9677]*	-3.5028 [-3.5742]*	-	-	I(0)

PP	-2.1530 [-2.9604]	-2.9608 [-3.5628]	-11.2007 [-2.9639]*	-36.7236 [-3.5683]*	I(1)
$\boldsymbol{GOVEFF_t}$					
ADF	-3.2943 [-2.9604]**	-4.1791 [-3.5628]**	-	-	I(0)
PP	-3.2943 [-2.9604]**	-4.0432 [-3.5628]**	-	-	I(0)
$\boldsymbol{DCP_t}$					
ADF	-2.5672 [-2.9639]	-3.7738 [-3.5683]**	-5.0548 [-2.9718]**	-	I(0)/I(1)
PP	-1.7184 [-2.9604]	-2.1149 [-3.5628]	-5.5938 [-2.9639]*	-6.0238 [-3.5683]*	I(1)

, **, *, and [] denotes 1%, 5%, 10% and test critical values respectively.*

Source: Authors' Compilation using Eviews 10.

4.4. ARDL Cointegration Bound Test

As such, to assess the stationarity of each variable, the study used two different tests namely the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. However, the result of the unit root test as revealed in Table 3 showed that using the ADF unit root test, income inequality and domestic credit to the private sector were stationary at the first difference, at the same time, the log of government expenditures on education and health were stationary at levels. On the other hand, the PP unit root test revealed that all the variables were stationary at first difference while government effectiveness was stationary at level. Therefore, the unit root test summary was stationary at levels I(0) and stationary at first difference; I(1) using the ADF and PP. This prompts the choice of the ARDL technique to evaluate the presence of a co-integrating relationship, which has distinct benefits over existing symmetric co-integration tests (Pesaran, Shin, & Smith, 2001). To support this decision, the ARDL approach may be used for variables with varied degrees of stationarity (Pesaran & Shin, 1995) and stationary variables at the first difference (Shrestha & Bhatta, 2018).

Thus, since mixed stationarity exists among the variables, running an ARDL bound test is essential to determine whether the model cointegrates. Hence, [6] is specified to implement the ARDL bound test technique.

$$\Delta INCEQ_t = \beta_0 + \lambda_1 INCEQ_{t-1} + \lambda_2 LGEDU_{t-1} + \lambda_3 LGHE_{t-1} + \lambda_4 GOVEFF_{t-1} + \lambda_5 DCP_{t-1} + \sum_{i=1}^{p} \gamma_{1i} \Delta INCEQ_{t-i} + \sum_{j=1}^{q_1} \gamma_{2j} \Delta LGEDU_{t-j} + \sum_{j=1}^{q_2} \gamma_{3j} \Delta LGHE_{t-j} + \sum_{j=1}^{q_3} \gamma_{4j} \Delta GOVEFF_{t-j} + \sum_{j=1}^{q_4} \gamma_{5j} \Delta DCP_{t-j} + \rho_t \quad [6]$$

Where Δ are the operators of the first difference, $\gamma_1 - \gamma_5$ are the vector parameters of the long-run estimates, $\lambda_1 - \lambda_5$ are the vector parameters of the short-run estimates, p and $q_1 - q_4$ are the optimal lag length, β_0 is the constant parameters, and ρ_t is the stochastic white noise. As such, as developed by Pesaran et al. (2001), using the ARDL bound test, the F-test is used to determine whether there exists a short-run or long-run cointegration. However, to investigate the direction of the cointegration, the rejection of the null hypothesis indicates that there is a long-run relationship among the variables specified in [6]. Thus, the cointegration null hypothesis is estimated in [7],

$$\mathbf{H_0}: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \quad [7]$$

Hence, using the ARDL bound test, together with the derived F-statistic, presents two values: the lower bound, I(0), and upper bound, I(1) to assess a short-run or long-run co-integration among the variables. Through the bound test rule, if the value of the F-statistic is less than I(0) of the lower bound value, it means

that the variables do not cointegrate with each other and vice versa. Table 4 revealed that there is a long-run relationship between human capital, institutional quality, and income inequality in Nigeria with also results that the variables are cointegrated with each other. Then, there is a need to correct the disequilibrium based on the co-integration of the variables with each other between the period of 1991 and 2021.

Table 4

ARDL Bound Test Results

Significance Level	I(0)	I(1)	K	Selected Model	F-Statistic
10%	2.2	3.09	4	ARDL (2, 1, 0, 1, 1)	5.3585
5%	2.56	3.49			
1%	3.29	4.37			

Source: Authors' Compilation using Eviews 10.

4.5. Discussion of Results

Table 5 captures the estimates of human capital, institutional quality, and income inequality in Nigeria having together the long-run estimates through the ARDL long results and the short-run estimates through the ECM. As such, in the long-run estimates, the study revealed that the disaggregated proxies for human capital, that is, government expenditures on education and health were not significant but had a positive effect on income inequality in the long run, and negative when lagged by one period in the long-run for government expenditure on education.

These positive effects in the long run by government expenditures on education and health increase income inequality by 0.16%, and 0.07% respectively in the initial year but with a one percent increase in government spending on education, income inequality is reduced by 0.08% in the preceding year. The positive but not significant effect of government expenditure on education on income inequality is supported by the findings of Sharimakin, Oseni, and Adegboye (2015), Selem-Amachree and Ezekwe (2021), and Ali (2022) while the positive and insignificant effect of government expenditure on health on income inequality is also supported by the findings of Chude, Chude, Anah, and Chukwunulu (2019), Obayori (2020), and Ali (2022) which showed that investments in human capital plays a positive impact on income inequality. It then revealed that human capital investment in Nigeria reduces income inequality in Nigeria but the interaction of the effectiveness of the Nigerian government's is not sufficient for human capital investment to reduce income inequality gap. Estimates of the long-run results revealed that the government's effectiveness at the initial year and when lagged both had a positive effect on income inequality in the long run, but insignificant in the initial year. The result showed that in the initial year, a one-unit increase in government effectiveness brought about a 0.11% increase on income inequality in Nigeria.

Moreover, there exists a positive and significant effect if government effectiveness is lagged by one period, a one-unit increase leads to a 0.43% increase in income inequality in Nigeria. As such, the result implies that government effectiveness has a positive effect on income inequality in the long run, and it is consistent with the findings of Fagbemi, Oladejo, and Adeosun (2020), and Kouadio and Gakpa (2022). This positive impact reflects poor governance impede and promote the increase in poverty rates and income inequality. Similarly, domestic credit to the private sector revealed that in the long run, in the initial year and when lagged both had a positive effect on income inequality. Unlike government effectiveness in Nigeria on income inequality, in the initial year, it was revealed to be insignificant and significant when lagged by one period. To this end, the result showed that in the initial year, a one percent increase in domestic credit to the private sector brought about a 0.02% increase on income inequality in Nigeria. The implication of the result revealed that domestic credit to the private sector has a positive effect on income inequality in Nigeria in the long run. This

is supported by the findings of Ilori (2020), and Adeleye (2021). To this end as revealed by the study, it means that financial instability as a result of poor governance in the financial sector play an important role in inflicting poverty and increasing the gap of income inequality in Nigeria. This typically explains the recently new naira note which practically affects Nigerians as a result of decisions of the Central Bank of Nigeria through the Nigerian government.

The coefficient value of the error correction term (ECT) in the short-run estimates as revealed in Table 5 illustrates how the system returns to equilibrium following a transient shock. The amount of the ECT reflects the rate at which any disequilibrium is adjusted towards a long-run equilibrium, as the departure from long-run equilibrium is rectified using short-run partial dynamics. The ECT (-1) coefficient is negative and significant. The coefficient indicates that the short-run offsets 11.6% of the model's disequilibrium on an annual basis to restore long-run equilibrium. This suggests that the model will adjust to equilibrium at a rate of 11.6% in the year after the sampling period. The adjusted R-squared analysis reveals that independent variables affect the dependent variable by 86.3% in the short run and 99.8% in the long run, with the remaining percentage explained by other variables. The F-statistic and Durbin Watson (DW) statistics indicate a strong linear dependency between government expenditures on education and health, government effectiveness, and domestic credit to the private sector.

Table 5

Estimates of human capital, institutional quality, and income inequality in Nigeria

				Long-run Estimates: ARDL
Variable	**Coefficient**	**Std. Error**	**t-Stat.**	**Prob.**
$INEQ_{t-1}$	1.359799	0.127218	10.68873	0.0000
$INEQ_{t-2}$	-0.475549	0.098910	-4.807885	0.0001
$LGEDU_t$	0.001610	0.001225	1.313542	0.2039
$LGEDU_{t-1}$	-0.000798	0.000506	-1.577272	0.1304
$LGHE_t$	0.000664	0.001226	0.542100	0.5937
$GOVEFF_t$	0.001139	0.001379	0.825852	0.4186
$GOVEFF_{t-1}$	0.004354	0.001392	3.127831	0.0053
DCP_t	5.47E-05	5.37E-05	1.018111	0.3208
DCP_{t-1}	0.000148	6.07E-05	2.429578	0.0247
Constant	0.016858	0.004276	3.942758	0.0008
Adj. R-Sq.	0.998478		F-statistic	2114.669
D-W stat.	2.475801		Prob. (F-statistic)	0.000000
				Short-run Estimates: ECM
Variable	**Coefficient**	**Std. Error**	**t-Stat.**	**Prob.**
$\Delta(INEQ_{t-1})$	0.475549	0.065390	7.272549	0.0000
$\Delta(LGEDU_t)$	0.001610	0.000281	5.736958	0.0000
$\Delta(GOVEFF_t)$	0.001139	0.000967	1.178124	0.2526
$\Delta(DCP_t)$	5.47E-05	4.07E-05	1.343393	0.1942
ECT_{t-1}	-0.115750	0.018259	-6.339494	0.0000
Adj. R-Sq.	0.863762		D-W stat.	2.475801

Source: Authors' Compilation using Eviews 10.

4.6. Post-Diagnostic Test Results

The results of the post (residual) diagnostic tests are presented in Table 6. The results showed that all tests had a probability value greater than 5%, indicating that the null hypothesis of no serial correlation, heteroskedasticity, or non-normality was not rejected and that the model was correctly specified. This suggests that the model is normally distributed and does not have homoscedastic variances or serial correlations. To ensure model stability, the study used the cumulative sum of recursive residues (CUSUM) and cumulative sum

of recursive residue squares (CUSUM Sq.), as seen in Figure 2. The graph indicates that the model is stable across the estimating period, with residues falling within the 95% confidence range and 5% critical bounds. In summary, the results show that the model has no econometric issues.

Table 6

Post (residual) diagnostic test results

Test	Statistic value	Prob.
Normality test	JB = 1.014998	0.601999
Breusch-Godfrey serial correlation LM test	1.147077	0.3397
Breusch-Pagan-Godfrey heteroscedasticity test	0.851715	0.5801
Ramsey RESET test	2.038489	0.1696
Cumulative sum of recursive residuals	Stable	
Cumulative sum of squares of recursive residuals	Stable	

Source: Authors' Compilation using Eviews 10.

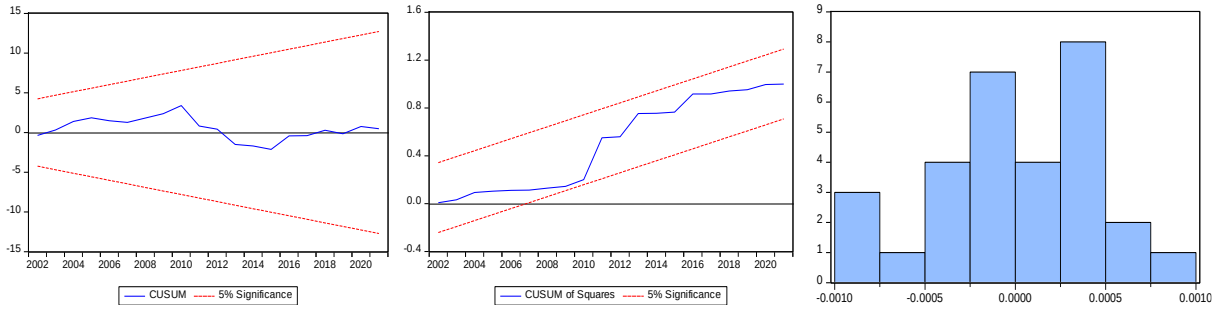


Fig. 2. Model structural stability test, and histogram

Source: Authors' compilation using EViews 10.

5. Conclusion

Empirical analysis and investigations have been conducted into how human capital and institutional quality affect income inequality, emphasizing public expenditures on education and health and government effectiveness in decision-making. Although few studies have tried to capture and host an inquiry on the study's subject matter in Nigeria, existing studies focused on the aim of the study in Africa, MENA, sub-Saharan African countries, and amongst other nations in the world, resulting in mixed recommendations and findings. Thus, this study is different from others as it captures the effects of human capital and institutional quality on income inequality in Nigeria and whether the independent variables reduce income inequality in Nigeria from 1990 to 2021. The study adopts the Kuznets model as its theoretical framework and was analyzed using a unit root test, namely the ADF and PP tests, to determine the level of stationarity of each of the series, and it was then revealed that there exists a mixed level of stationarity in the variables. Consequently, the study employs the ARDL estimation technique as it is the technique that accommodates variables with mixed levels of stationarity.

Then, to determine the cointegration direction among the variables, the ARDL bound test result shows that the variables cointegrated and had a long-run relationship. As such, the ARDL long-run result revealed that public health expenditure, government effectiveness, and domestic credit to the financial sector positively reduce income inequality in Nigeria. On the contrary, public expenditure on education deters and causes income inequality. This means that the demand and need for education in Nigeria do not command the reduction of income inequality. Although, in the short run, having corrected the disequilibrium that exists in the model as a result of the long-run cointegration, the public expenditure on education has a significant and

positive effect on the reduction of income inequality, which may occur as a result of the positive effect of domestic credit on the private sector and maintaining a stable institutional quality in the short run.

The result of the diagnostic test showed that the model was free of econometric problems. Sequel to the findings, the study recommends that the government should by all means increase the budget of human capital to enhance the reduction of income inequality in the country. Also, since the public expenditure on education is not significant but positively has an effect on income inequality in the long run, the study recommends that policymakers should place more emphasis on providing education grants and incentives that encourage the reduction of brain drain to elevate the demand for quality education. It supports the results since domestic credit to private sectors positively influences the reduction of income inequality in Nigeria. Despite the relevance and contribution of the study to literature, the paper suffered a limitation of data source to the present year on the conducting of the study. Due to the fact that the data were not available to the present year establishes the limitation of the study to truly capture the recent impact institutional quality as catalyst for income inequality through investments in human capital. Then, the paper suggest to further studies to investigate the interactions between the investments in human capital, institutional quality and income inequality in Nigeria and sub-Saharan economies.

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