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Social Science Research

Education Human Capital Development and Per Capita Income in Nigeria: A Bivariate Granger Causality Analysis

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ABSTRACT

Despite government efforts to promote adequate education and to reduce the negative consequence of inadequate educational system for human capital development, educational outcomes in Nigeria lags behind when compared with other countries even in Africa. This has constrained growth and human capital development. This study examined the relationship between education human capital development and per capita income in Nigeria from 1986 to 2021. The data set for this study were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin of various issues and the Nigerian Bureau of Statistics (NBS). The Granger cuaslity test was employed. The analysis was anchored on the endogenous growth model. The result showed that education index and education expenditure were positively related to per capita income. The result further showed that capital expenditure, inflation and population growth, proxy for labour force were negatively related to per capita income, while health index and poverty headcount were positively related to per capita income. This paper recommended among other other policy options that the Government should promote and strengthened free and compulsory primary and secondary school enrolment so as to promote income of the citizenry.

KeyWords: Education, human capital development, education index, Granger causality, Nigeria, per capita income

JEL Codes: I20, O15, D31

1. Introduction

Government expenditure will promote school outcomes, which in turn will promote per capita income. Qualitative education is a standard for every developing and developed economy as it enhances employment, productivity and personal income generation for economic well-being. Inadequate education implies, denying the economy the needed human capital development but also income for well-being. Therefore, for developing countries like Nigeria to progress with poverty reduction, inequality and exclusive growth, there must be adequate education which promotes human capital development.

However, despite government efforts to promote adequate education and to reduce the negative consequence of inadequate educational system for human capital development, educational outcomes in form graduates and skill development lags behind when compared

countries even in Africa. This is a major challenge which has not only constrained growth, human capital development but has also hindered poverty reduction following poor income generation with the educational qualification.This challenges are also due to poor budgetary allocation to the education sector, as the sector is faced with the less than the recommended 26 percent of United Nations Education Fund.

Quite a number of empirical studies have investigated the impact of education on economic growth as abound in the development literature. For example (Anand & Ravallion, 1993; Appleton *et al.*, 1996; Filmer & Pritchett, 1997; Mingat & Tan, 1998; Gupta *et al.*, 2002; Baldacci *et al.*, 2004; Anyanwu & Erhijakpor, 2007; Appiah, 2017; Mingat & Tan, 1992, 1998; Flug, Spilimbergo & Wachenheim, 1998; Ayara 2003; Dauda 2009;, Omojimite 2010; Lawal and Wahab 2011; Odeleye 2012; Ehigiamusoe 2013; Yusuf,2014, Omodero & Azubuike 2016, Aigbedion, Iyakwari, and Gyang 2017; Ogunleye, Owolabi, Sanyaolu & Lawal 2017; Elumah & Shobayo 2017; Ayeni and Omobude 2018; Ogunniyi 2018; Etale and Enemugha (2019), Bako & Zakariya 2019, Omodero &Nwangwa 2020)

As empirically evident, these studies showed, they are fraught with empirical challenge or the other. Majority have focused on growth; most of the empirical results are conflicting, while showed negative relationship, some other suggested positive relationship and some inconclusive. This inconsistency distorts policy formulation from these empirical evidences, this paper becomes imperative to bridge the gap arising from the shortcoming of previous empirical attempts. This paper examined the relationship between education human capital development and and per capita income in Nigeria from 1986 to 2021 using the econometric techniques.

The rest of this paper is structured as follows. Section 2 is on the methodology, framework and model building. Section 3 presnts the results and discussion for policy inference while section 4 concludes the paper with policy implications of findings.

2. Methodology/Theoretical Framework/Model

2.1 Theoretical Framework

The theoretical framework of this study is anchored on the endogenous growth theory as already espoused in the basic review of theories. Endogenous growth theory maintains that economic growth is primarily the result of internal forces, rather than external ones. The AK model, which is the simplest endogenous model, gives a constant-saving rate of endogenous growth and assumes constant returns to scale. The model is based on the assumption that the production function does not exhibit diminishing returns to scale. The AK model production function is a special case of a Cobb-Douglas production function

$$Y= AK^{a}L^{1-a} \qquad 3.1$$

Where Y represents the total production in an economy, A represents total factor productivity, K is capital, L is labour and the parameter a measures the output elasticity of capital. For the special case in which a = 1, the production function becomes linear in capital thereby giving constant returns to scale:

$$Y = AK \quad 3.2$$

2.2 Empirical Model Specification

Following the endogenous growth model and adapting the equation of Appiah (2017), stated as:

$$Y = AF(K, L) \quad 3.3$$

Where Y represents per capita income; K denotes capital stock as its share of per capita GDP; L describes the amount of unskilled labour; and A represents technology. Following the relationship between labour and technology represented by efficiency factor, the model is re-specified as:

$$Y = F(K, AL) \quad 3.4$$

From the modification of equation (3.4), a linear model was specified as follows:

$$PCI = \alpha PCI_{t-1} + \beta_1 EDUIND + \beta_2 EDUEXP + \beta_3 HEIND + \beta_4 INFL + \beta_5 PGR + \beta_6 POHR + \beta_7 UNEM + U_t \quad (3.5)$$

Where PCI is per capita income; PCI_{t-1} is the income inertia; EDUIND is education index- enrolment, attainment and mean year of schooling; EDUEXP is education expenditure by the public sector, measured in percentage of GDP; HEIND is health index- infant mortality, under-five mortality and life expectancy; PGR is population growth rate, representing the endogenous growth model and POHR is poverty headcount ratio, capturing the poverty line and UNEM is unemployment rate and Ut is the stochastic error term.

The data for this paper were sourced from the Central Bank of Nigeria Statistical Bulletin (NBS), National Bureau of Statistics (NBS) and African Development Bank database for the various years.

2.2.1 Theoretical Postulations (Theoretical Expectations)

Table 3.1 presents the theoretical postulations.

Table 2.1:

Dependent variables	Independent/control variables	Parameter expected signs	Remarks
PCI Per capita income	EDUIND, education inxed EDUEXP, education expenditure HEIND, health index INFL, inflation rate PGR, Population growth rate POHR, poverty headcount UNEM, unemployment	+ >0 +>0 + >0 +>0 - <0 +, >0 +, <0	Positive Positive Positive Positive Negative Positive Negative

Source: Authors' Compliaion (2023)

2.3 Estimation Techniques and Procedures

The estimation technique is the Granger and procedurally, i) descriptive statistics, ii) unit root test, iii) cointegration test.

The standard Granger causality test as proposed by Granger (1969) was also employed to determine the statistical properties of the coefficient of the linear regression. Procedurally, the analysis would commence with the descriptive statistics, the correlation matrix, the unit root test, and the cointegration test. This will be followed by the ordinary least square, the Granger causaliy test, the diagnostic and stability test and the model stability test.

3 Result Presentations, Analysis and Discussion of Findings

3.1 Summary of Descriptive Statistics

Table 3.1: Descriptive Statistics

Variables	Obs	Mean	Std.Dev.	Jargue-Ben	Min	Max	Skewness
PCI	40	1037682	1843.423	365.55	20522	9801390	3.588468
EDUINDEX	40	0.614391	0.071865	3.780	0.530520	0.739590	0.338694
EDUEXP	40	935502.0	1567540	815.7358	27540.00	9475021	4.301922
HEALTHINDEX	40	0.234864	0.022882	1489.963	0.225691	0.368950	5.20388
INFLATION	40	18.96674	16.89354	29.79203	5.38220	72.83100	1.820851
PGR	40	2.605514	0.085610	2.435796	2.3425	2.746893	0.5649
PHR	40	1.912685	2.135036	35.05637	0.26940	9.383700	1.81933
UNEM	40	12.26300	5.217186	1.531254	3.500000	23.6500	0.11348

NB: PCI = Per capita income; EDUINDEX = Education index, EDUEXP = Education expenditure; HEALTHINDEX = Health index; INFLATION = Inflation; PGR = Population growth rate; PHR = Poverty health ration and unemployment.
Source: Authors' computation from EView 11 Software

The Table shows that PCI has an average value of 1036782 with minimum and maximum values of 20522 and 9801390 respectively. This implies that on the average, the value of PCI ranges between 205522 and 9801390, which at the value 80840 is pwr given the level of endowments in Nigeria. Again, the average of EDUINDEX is about 0.614391, 9355020 for EDUEXP. The health index has a value of 0.23468. Among the series, EDUINDEX, HEALTHINDEX and PGR have the least standard deviation since the level of investment in

human capital development in Nigeria has not witnessed the significant and desired changes. Finally, the Jarque-Bera statistics value rejected the null hypotheses of normal distribution for PCI, EDUEXP, INFLATION.

3.1.1 Unit Test

Table 3.2: ADF and PP unit Root Results at Levels and First Differences

	AUGMENTED DICKEY-FULLER (ADF) TEST		PHILIPS-PERSON (PP) TEST	
Variables	**Levels 1(0)**	**First Difference 1(1)**	**Levels 1(0)**	**First Difference 1(1)**
PCI	-3.61045*	-	4.31	-2.91
EDUINDEX	-3.621023	-	-2.87	-6.59
EDUEXP	-610453	-5.668742	-2.54	-1.98
HEALTHINDEX	-3.610452	-2.353979	-1.75	-3.22
INFLATION	-3.610452	-3.265542	-2.87	-3.82
PGR	-3.646342	-3.265542	-4.46	-4.62
PHR	-3.132562	-4.132562	-1.75	-3.22
UNEM	- 0.086784	-3.610453	-1.43	-1.78

Source: Authors' computation using EView11 Software

Table 3.2 showed that the majority of the variables where stationarity at the levels mostly the ADF values at the 1 percent critical values of (-2.2723). The presence of unit root lead to the cointegrating rank test Table 3.3.

Table 3.3: Cointegration Rank Test (Johansen)

Hypothesized No of CE(s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob
None *	0.997796	855.5488	334.9837	0.0000
At most 1*	0.979276	623.0854	285.1425	0.0000
At most 2*	0.960846	475.7806	239.2354	0.0000
At most 3*	0.868379	352.6514	197.3709	0.0000
At most 4*	0.839621	275.5933	159.5297	0.0000
At most 5*	0.763076	206.0456	125.6154	0.0000
At most 6*	0.724503	151.3246	96.75366	0.0000
At most 7*	0.638484	102.3359	69.81889	0.0000
At most 8*	0.572801	63.67262	47.85613	0.0009
At most 9*	0.425680	31.35366	29.79707	0.0328
At most 10*	0.214216	10.28009	15.49471	0.2598
At most 11*	0.029026	1.119300	3.841466	0.2901

Source: Authors' computation using EView 11 Software.

Trace test indicate 10 cointegration(s) at the 0.05 level

* denote rejection of the hypothesis at the 0.05 level

** Mackinnon-Haugh-Michels (1999) P – values

Table 3.3b: Cointegration Rank Test (Johansen)

Hypothesized No of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.
None *	0.997796	232.4634	76.57843	0.0001
At most 1*	0.979276	147.3077	70.53513	0.0000
At most 2*	0.960846	123.1293	64.50472	0.0000
At most 3*	0.868379	77.05760	58.43354	0.0000
At most 4*	0.839621	69.54816	52.36261	0.0004
At most 5*	0.763078	54.72097	46.23142	0.0050
At most 6*	0.638484	38.66306	33.87687	0.0124
At most 7*	0.572301	32.31916	27.58434	0.0114
At most 8*	0.425680	21.07357	21.13182	0.0509
At most 9*	0.214216	9.160786	14.26460	0.02730
At most 10*	0.029026	1.119300	3.841466	0.2901

Source: Authors' Computation Using EVIEW 11 software

Max-eigenvalue test indicates 9 cointegration(2) at the 0.05 level.
*denote rejection of the hypothesis at the 0.05 level
** Mackinnin – Michell (1999) P – values.

The cointegration tests of Johansen and Juselius revealed 6 cointegrating equation(s) at the 0.05 level of significance for both the Trace and Max-Eigen Statistics. The implication is that there exists long-run equilibrium relationship between education human capital development and per capita income. All things being equal, the higher the level of education, the higher the income.

Table 3.4: Regression Results

Variable	Coefficient	Std. Error	t-statistic	Prob.
C	11.32102	7.683592	1.473402	0.1514
LOG(EDUINDEX)	0.454586	3.069683	0.148090	0.8833
LOG(EDUEXP)	0.590749	0.116012	5.092124	0.0000
LOG(HEALTHINDEX)	2.696873	1.540373	1.750792	0.0906
LOG(INFLATION)	-0.017415	0.167097	-0.104221	0.9177
LOG(PGR)	-6.865203	3.544673	-1.936766	0.0626
LOG(PHR)	0.378801	0.351166	1.078696	0.2896
LOG(UNEMPLOYMENT)	-0.070238	0.584015	-0.120268	0.9051
R-squared	0.811871	Mean dependent var.		13.12467
Adjusted R-Squared	0.746999	S.D. dependent var.		1.144637
S.E. of regression	0.575744	Akaike info criterion		1.962108
Sum Squared resid	9.612944	Schwarz criterion		2.426550
Log Likelihood	-28.24216	Hannan-Quinn Criterion		2.130036
F-Statistic	12.51495	Durbin Watson		2.278174
Prob (F-Statistic)	0.00000			

Source: Authors' computation using EView 11 Software

The results for each of the variables are considered below in turn. As Table 3.4 indicates, there is a positive relationship between education index and per capita income. This implies that as the level of school attainment, mean years of school and primary and secondary school enrolment increases, income earned from the education skill and certificate obtained also increases. The empirical result also means that there could be a critical level of development in education necessary to optimize income stream.

Government capital expenditure shows an inverse relationship with per capita income, hence, as government capital expenditure increases/decreases, it will automatically have a similar impact on per capita income. The results contradict Chandana et al (2021) who suggested a positive and significant relationship on economic growth. In developing countries like Nigeria, the variation in government spending pattern is not only projected to guarantee stabilization but also to spur economic growth and expand employment opportunities.

Health index was also found to be positively related to per capita income. The indices include: life expectancy, under-fore mortality rate and maternal mortality rate. Good health promotes higher income. For population growth rate, an increase in the variable reduces economic growth by 6.85 percentages. This implies that the higher the absorbed labour force, the greater the increase in income. The poverty headcount ratio showed a positive relationship with per capita income. Low income or no income leads to poverty.

The summary statistics show R^2 coefficients of determination value of 0.811871, which implies that the proportion of variation in per capita income is explained 81 percent by the independent and control variables of education index, education expenditure and healthindex. At 75 percent, the R-Bar squared showed that economic growth model has a good predictive ability. The F-statistics at 12.5 showed that existence of a significant linear relationship exist between per capita income and education human capital development. This implies that the model of our study is reliable for prediction. The Durbin Watson statistics at 2.27 showed that the per capita income and education human capital is free from first autocorrelation challenges and therefore, the model has implications for policy inference**.**

3.2 Granger Causality Test Results

The results of the Pairwise Granger Causality tests are presented in Table 3.5

Table 3.5: Pairwise Granger Causality

Null Hypothesis	Obs	Prob.	Decision
HEALTHINDEX does not Granger Cause PCI	34	0.0295	Accept
EDUCATIONINDEX does not Granger Cause PCI	34	0.2472	Reject
EDUEXP does not Granger Cause PCI	34	0.9749	Reject
Inflation does not Granger Cause PCI	34	0.9170	Reject
PGR does not Granger Cause PCI	34	2.E-07	Accept
PHR does not Granger Cause PCI	34	0.9184	Reject
Unemployment does not Granger Cause PCI	34	0.3353	Reject

Source: Authors' Compuation using EView 11 Software

The results in Table 3.5 indicate that there exists no relationship between per capita income and health index since the null hypothesis was accepted. The rest of the variables showed the rejection of the null hypothesis implying that there is a relationship between the variables of interest.The reliability of our model has been demonstrated by applying a series of diagnostic models to meet the requirements for the quality of residuals. Table 3.6 provide the model diagnostic tests.

Table 3.6: Model Diagnostic Tests

	Test	**F-statistic**	**Probability**
1.	Normality (Jarque-bera) Statistics	0.5617	0.75515
2.	Serial Correlation Breuseh-Godfrey LM Test	0.461687	0.907472
3.	Autoregressive Conditional Heteroskedesticity	3.433563	0.004063
4.	Ramsey Reset Test	0.6245	0.86325

Source: Researchers' Computation using EVIEW 11 software

Table 3.6 showed that there's no heteroscedasticity or autocorrelation in the model. Autocorrelation LM test rejects the null hypothesis that there is no serial correlation at significance less of than 0.05. As shown in figure 4.1 and 4.2, neither the recursive residuals nor CUSUM square plots cross the 5 percent critical lines, therefore, it can be safely concluded that the estimated parameters are relatively stable, well specified and robust for policy analysis.

CUSUM

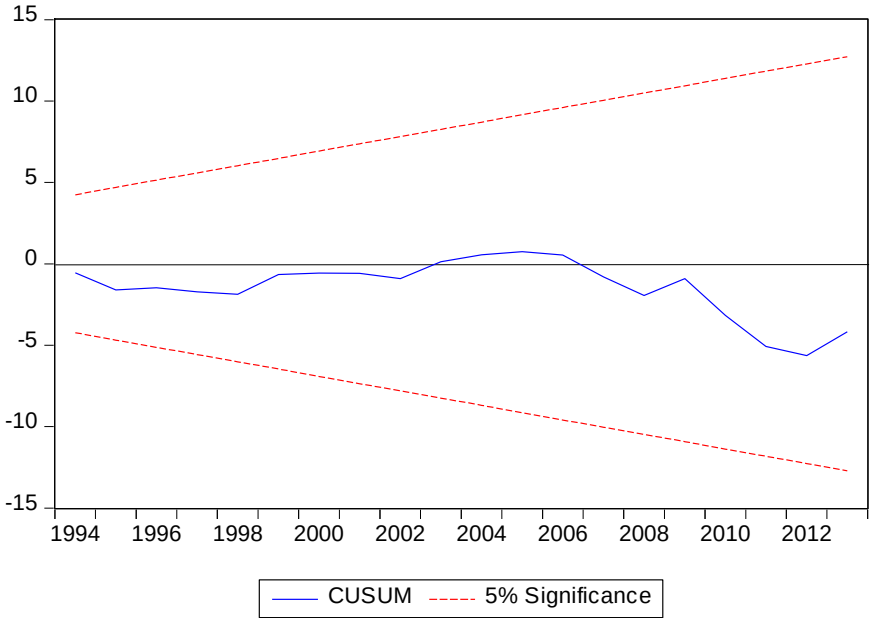

Figure 4.1: **CUSUM OF SQUARES**

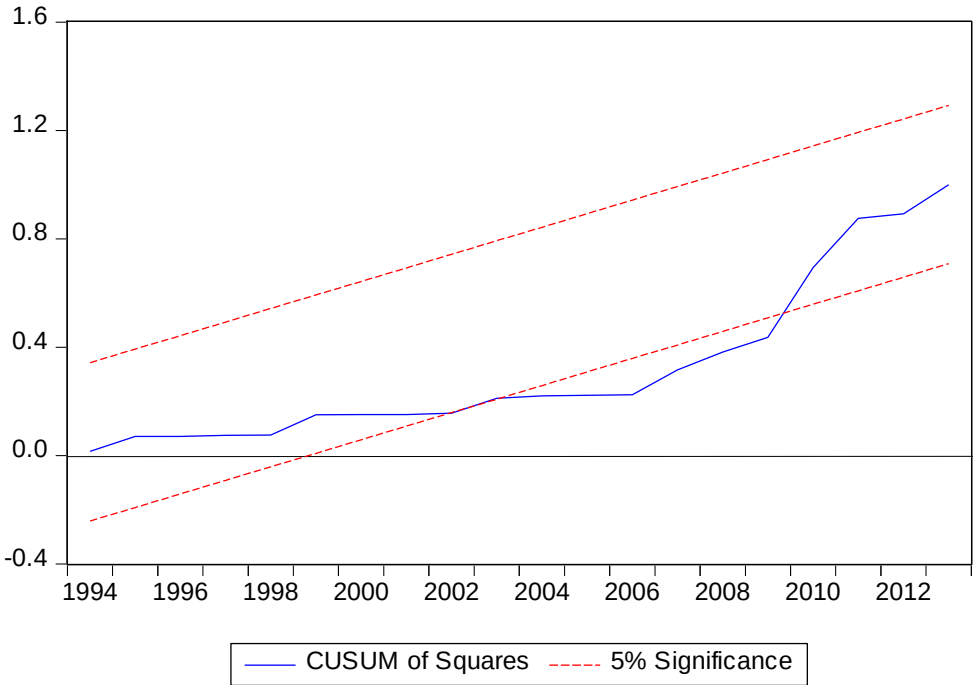

Figure 4.2: CUSUM of Squares

3.3 Policy Implication

The empirical results and estimates have some policy implication which forms the basis of policy pronouncements

1. The variables of education index and education expenditure were positively related. This implies that government policy measures for promoting school attainment and school enrollment needs to be sustained and encouraged so as to promote capita income.
2. Government capital expenditure, inflation, population growth rate and unemployment needs to addressed and effective solution initiated as they are negatively related to economic growth.
3. Health index and poverty headcount ratio were positively related to per capita income. Hence, health policy measures aimed at improving health outcome needs to sustained and made efficient so as to promote per capita income

4 Conclusion and Policy Recommendations

This paper examined the relationship between education human capital and per capita income in Nigeria between the period 1986 and 2021 and employed the Granger Causality approach and the OLS analytical techniques. From the OLS regression result, it was suggested that education index showed a positive relationship with per capita income line with the theoretical assumption, such that 1 percentage increase in education index accounted for 45 percent increase in per capita income. The coefficients of government capital expenditure, inflation, population growth and unemployment were found to negatively impact on per capita income in Nigeria. The coefficient of determination (R^2) at 0.811871 implies that the variation in per cpaita income. The Durbin Watson Statistic of 2.27 showed that the estimates

are free from serial autocorrelation and the diagnostic test statistics – Normality test (Jarque-Bera); serial correlation test (LM test); the autoregressive conditional heteroscedasticity test and the Ramsey reset test for linearity are all plausible and therefore by inference robust for economic policymaking.

4.1 Policy Recommendations

In line with the policy implication of the study and the parameter estimates, the following policy actions are suggested for initiation and implementation:

i. Policy measures that target school enrollment and school attainment should be improved in Nigeria. For example, free education for primary and secondary should be encouraged.
ii. The negative relationship between education human capital development and per capita income showed that Government policy measures towards the promotion of income through education and training has not being effective in inducing income. The positive relationship between health index, and poverty headcount showed that policy measures towards these variables should be strengthened. Health faclitities and infrastructure should be provided and enhanced for efficiency.

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