CINEFORUM
ISSN: 0009-7039

Vol. 65. No. 4, 2025

Impact of Formal Education on Economic Growth in Nigeria: A Composite Analysis

[1]Kenneth Onyeanuna Ahamba, [2]Hycenth Oguejiofoalu Richard Ogwuru, [3]Leona Eucharia Ekechukwu, [4]Cletus Offor Onwuka, [5]Nwamara Chidiebere Isilebo, [6]Chima Nwabugo Durueke, [7]Aloysius Orogwo Alo, [8]Chioma Rose Chime-Nganya, [9]Chukwuemeka Ononuju Nwankiti, [10]Michael Eze Odo, [11]Alieze Sunday Ekpa, [12]Chibuikem Sunday Ohanaka

[1,4]Department of Economics and Development Studies, Alex Ekwueme Federal University Ndufu-Alike, Ebony State, Nigeria

[2]Department of Economics, Novena University Ogume, Delta State, Nigeria

[3,7,10,12]Department of Educational Management and Foundational Studies, Alex Ekwueme Federal University Ndufu-Alike, Ebonyi State, Nigeria

[5]Department of Educational Foundation, University of Nigeria Nsukka, Enugu State, Nigeria

[6]Department of Business Management Studies, University of Hull, United Kingdom

[8,9]Department of Mass Communication, Alex Ekwueme Federal University, Ndufu-Alike, Ebonyi State, Nigeria

[11]Department of Educational Management, Enugu State University of Science and Technology, Enugu

Authors' emails: [1]ahamba.kenneth@funai.edu.ng or kendrys4jesus@yahoo.com; [2]profecahoro@gmail.com; [3]ekechukwuleonaeucharia@gmail.com; [4]cletus.onwuka@funai.edu.ng; [5]chidiebere.isilebo@unn.edu.ng; [6]C.DURUEKE2-2023@hull.ac.uk; [7]aloysiusorogwu8@gmail.com; [8]chiomaovykes@gmail.com; [9]chukwuemeka.nwankiti@gmail.com; [10]odomichaeleze@gmail.com; [11]sonyekpa@gmail.com; [12]chibyoha@gmail.com

Corresponding author's email: ahamba.kenneth@funai.edu.ng or kendrys4jesus@yahoo.com

Abstract:

The value of real gross domestic product has been low, and the actual growth rate of real gross domestic product has fallen below the targeted growth rate on most occasions in Nigeria, despite the huge turnout of graduates from the formal education system. Therefore, this study examines the impact of formal education on economic growth in Nigeria from 1981 to 2020. The specific objectives of the study include the determination of the impact of composite formal education index and changes in the National Policy on Education on real gross domestic product, and the investigation of their direction of causality in Nigeria. The model specification was guided by the endogenous growth theory and the peculiarities of the Nigerian economy. The study employed the autoregressive distributed lag and the Toda-Yamamoto causality methods of data analysis. Short-run result indicates that composite formal education index (CEIND) made insignificant positive impact on real gross domestic product, (RGDP) while National Policy on Education (NPE) made significant positive impact on RGDP. Long-run result shows that the composite formal education index made a significant positive impact on real gross domestic product whereas National Policy on Education made insignificant positive impact on RGDP. Toda-Yamamoto causality test reveals that both CEIND and NPE stimulate real gross domestic

product in Nigeria without a feedback effect. Diagnostic tests for normality, serial correlation, heteroskedasticity, and multicollinearity confirm the justification and validity of the findings. The study recommends vocational, innovative and creative education; increased budgetary allocation to the education sector; extension of the compulsory tuition-free primary education to the secondary education level, and adequate motivation of formal education workers to promote formal education for economic growth in Nigeria.
Keywords: Formal education, economic growth, ARDL, Toda-Yamamoto, Nigeria

1. Introduction

One of the major concerns of developing countries including Nigeria is the attainment of a stable and satisfactory economic growth. But over the last four decades, the value of Nigeria's real gross domestic product (RGDP) which is a proxy for economic growth has been low though with rising and falling trends, and the actual growth rate of RGDP has fallen below the country's targeted growth rate on most occasions (CBN, 2023). This suggests that the Nigerian economy may be growing below its potential, a serious problem that requires urgent policy intervention. Due to the peculiarity of the Nigerian economy, there are many determinants of economic growth in Nigeria, and different researchers have explored some of these determinants in an attempt to address Nigeria's economic growth problem. For instance, Babatunde and Shuaibu (2011), Akinleye, Olowookere, and Fajuyagbe (2021), Onwiodiokit and Otolorin (2021), Oyegoke and Aras (2021), and Ukangwa and Ikechi (2022) investigated the roles of macroeconomic drivers of money supply, inflation, capital formation, domestic investment, tax revenue, oil revenue, exchange rate, and foreign direct investment in fostering economic growth in Nigeria. Other studies like Yusuf (2014), Emediegwu and Clement (2016), Ayeni and Omobude (2018), Aigbedion, Iyakwari and Gyang (2017), and Ogunleye, Owolabi, Sanyaolu and Lawal (2017), Omojimite (2010), Omodero and Nwangwa (2020), Nenbee and Danielle (2021), among others, have examined the role of formal education in promoting economic growth in Nigeria producing mixed results. But the studies that focused on the formal education-economic growth nexus focused on school enrolment, budget allocation to education and government education expenditure, thus neglecting education attainment, education quality and education policies. The neglect of these vital formal education indicators by these studies could constitute a serious constraint and weaken their policy implications especially the role of formal education in fostering economic growth because the efficacy of macroeconomic drivers of growth is dependent on quality education (Wang and Wong, 2011). Again, the single education indicators used by these studies did not capture the total impact of the entire formal education on RGDP. To fill these knowledge gaps, the present study built a composite formal education index using all the vital education indicators of access to education (proxy by school enrolment rates), education attainment (proxy by school completion rate and mean years of schooling) and

education quality (proxy by adult literacy rate); and also constructed an education policy dummy; and investigated their short-run and long-run impacts on RGDP.

Formal education brings about economic growth by first developing the human capital which is indispensable in the production process. Human capital promotes productivity through healthy conditions, knowledge, skills, work experience and motivation (Eigbiremolen and Anaduaka, 2014; Igbal, Awan, and Tayyab, 2018; Keji, 2021). In fact, it is replete in the literature that formal education equips the human capital with the requisite productive knowledge, skills, and technologically innovative capacity which enhance employment opportunities, productivity and personal income generation for economic well-being and the overall improvement in economic growth (Asteriou and Agiomirgianakis, 2001; Lenkei, Mustafa and Vecchi, 2018; Mendy and Widodo, 2018). Therefore, effective and qualitative education is a quest for every developing and developed economy. To deny any individual the opportunity of formal education implies denying not only the individual to succeed, but also denying the country the expected tax revenues for expenditure and improvement in economic growth. The literature suggests that human capital development especially through formal education is justified by its positive impacts on individuals' lifetime incomes, social rate of return, increase in real aggregate output, economic development and poverty reduction (Barro and Sala-i-Martin, 2004; World Bank, 1995; Schultz, 1999). Primary education could affect economic growth within the endogenous paradigm as it has the potential to boost output (Loening, 2005; Grant, 2017). It enhances employment prospects, especially in small-scale businesses and agriculture, which account for about 85% of employment in Nigeria as well as increases income (GDP), especially for rural farmers (Shettima, 2017). Secondary education equips the human capital with improved skills for employment above primary education skills. This increases the level of productivity and income. Moreover, secondary education imparts better health knowledge and awareness which translates into improved health outcomes thereby promoting productivity and economic growth. Through teaching, practical training, research and development, tertiary education produces professionals and specialists with advanced productive skills, knowledge and expertise which promote economic growth. These key components are strategic to the economic performance of any nation (Oketch, McCowan and Schendel, 2014).

Successive Nigerian governments have utilized this knowledge to pursue policies aimed at improving formal education as a tool for promoting RGDP in Nigeria. These policies include: National Minimum Standards and Establishments of Institution Amendments which enables the private sector including individuals, religious bodies, civil society organizations (CSOs), non-governmental organisations (NGOs) and international development partners (IDPs) to participate in the provision of formal education; the Free Universal Basic Education (UBE) Act of 2004 to rectify the lapses of the Universal Primary Education (UPE) scheme launched in 1976; the establishment of Education Tax Act No. 7 in 1993 which imposed a tax of 2% on all the

assessable profits of all the companies operating in Nigeria to act as intervention fund to all levels of education; the repealing and replacement of the Education Tax Act with the Tertiary Education Trust Fund (TETFund) Act in 2011 to provide supplementary support to all levels of public tertiary institutions in Nigeria; the provision of Early Childhood Care Development and Education Centres (ECCDEC) and the issues of access, equality, equity-inclusiveness, affordability and quality; the launching of the National Economic Empowerment and Development Strategy in 2004 which laid great emphasis on education as a tool for national development (Okoroma, 2000; UNESCO, 2010); the enactment of the National Policy on Education (NPE) in 1977 and its revisions in 1981, 1998, 2004, 2007 and 2013 to accommodate changes in the direction of formal education brought about by technological innovation (Nwangwu, 2007; FRN, 2013; Gabriel, 2018). Despite these policy measures, RGDP is still low. Though there have been remarkable improvements in access to formal education and educational attainment, education funding and quality of formal education are still very low, and the latest economic recession of 2020 which was deeper than that of 2016 is the most worrisome aspect of it. Again, Nigeria could not realise its Vision 20:2020 which aimed at enlisting the country among the top 20 largest economies of the world in the year 2020. Following the background, therefore, the study investigated the impact of formal education on economic growth in Nigeria, and its causal link from 1981 to 2020 using the autoregressive distributed lag (ARDL) model and the Toda-Yamamoto causality test. The specific objectives of the study include the determination of 1. the impact of the composite formal education index and the changes in the National Policy on Education on the RGDP in Nigeria; 2. the direction of causality between the composite formal education index, the changes in the National Policy on Education and the RGDP in Nigeria.

The remainder of this paper is organized into Section 2, literature review, Section 3, methodology and data, Section 4, results and discussion, and Section 5, conclusion, policy implications and recommendations.

2. Literature Review

Concepts of education, formal education and economic growth

Education is “the development of the cognitive, affective and psychomotor domains and abilities of an individual for optimal function and performance in the society” (Ilechukwu, Njoku and Ugwuozor, 2014, p. 45). It is a process of learning. Education aids the acquisition of knowledge, skills, values, beliefs, and habits. “It is the process by which society deliberately transmits its accumulated knowledge, skills, and values from one generation to another” (Ngaka, Openjuru and Mazur, 2012, p. 110). It is a major determinant of employment, earnings and economic growth. Neglecting the economic importance of education would hinder the prosperity of future generations, with severe repercussions for poverty, social exclusion, and the

sustainability of social security systems (Woessman, 2015). There are different types of education depending on the context, methods, curriculum and teaching and learning materials used (Ngaka, Openjuru and Mazur, 2012). These include: formal, non-formal and informal education. Formal education refers to the hierarchically structured and chronologically graded education system that runs from primary (and in some countries from nursery) school to university, and includes specialized programmes for vocational, technical and professional training. Formal education usually leads to recognition and certification. Economic growth is the process whereby a country's real national and per capita income increases over a period of time, usually a year. Real gross domestic product (RGDP) is one of the best ways of accurately measuring the size of the economy. The RGDP growth rate is a yardstick for gauging the economy's general health as well as the people's well-being in the country. "In broad terms, an increase in real GDP is interpreted as a sign that the economy is doing well" (Callen, 2012, p.15). Therefore, RGDP is adopted by the study as a proxy for economic growth.

Educational policies in Nigeria

"Educational policies are initiatives mostly by governments that determine the direction of an educational system" (Okoroma, 2000, p.190). These policies in conjunction with other educational regulations as issued by the Federal Ministry of Education from time to time guide the operation of education systems in Nigeria. Some of these policies are presented in this subsection. Before 1977, the educational policy operated in Nigeria was that inherited from Britain in 1960 at independence (Okoroma, 2006). The inability of this policy to fulfil national objectives necessitated the need for a better policy. Hence, the first post-independence National Conference on Curriculum was held in November 1969 at the former National Assembly Hall, Lagos. The aim of the conference was to discuss the structure and content of Nigeria's education; and design new national goals which would guide the future and direction of education in Nigeria (NERDC, 1972; Fafuwa, 1974; Oyeleke & Akinyeye, 2013). Sequel to the 1969 conference, a National Seminar chaired by Chief S. O. Adebo was organised by the National Educational Research and Development Council (NERDC) in 1973. The seminar modified and perfected the 1969 conference resolution and gave birth to the introduction of free Universal Primary Education (UPE) in 1976, and the National Policy on Education (NPE) in 1977 (Akagbou 1985; Bello 1986; Okoroma 2000; Olatunji, 2018). The failure of UPE and the dissatisfaction arising thereof led to renaming and relaunching of the programme as Universal Basic Education (UBE) by Federal Government of Nigeria (FGN) in 1999 (Okoroma, 2006; UBEC, 2017). The UBE programme became effective in April 2004 when the compulsory free UBE Act was enacted (Irigoyen, 2017; Yamma & Izom, 2018). In addition to tuition free primary education, the UBE Act provides for free books, instructional materials, classrooms, furniture and lunch (Olatunji, 2018). The result of UBE programme appears worse than UPE due to corruption and implementation problems. In fact, the quality of public primary education in Nigeria become

more pathetic than the pre-1976 era (Okoroma, 2003). The 1977 NPE, which brought the 135 years of colonial domination and influences on Nigeria's curriculum to an end, replaced the 7-5-2-3 (7 years of primary education, 5 years of secondary education, 2 years Higher School Certificate Levels, and 3 years of university education) school system with the 6-3-3-4 (6 years of primary education, 3 years of junior secondary education, 3 years of senior secondary education, and 4 years of university education) system (Ehindero, 1986; Imam, 2012). The 6-3-3-4 was designed to turn out graduates capable of making use of their hands, their heads and their hearts (i.e., the 3Hs of education) (Uwaifo & Uddin, 2009).

The NPE witnessed some revisions in 1981, 1998, 2004, 2007 and 2013 to accommodate changes in the direction of education brought about by technological innovation (Nwangwu, 2007; FRN, 2013; Gabriel, 2018). The 1998 revision introduced the 9-3-4 (9 years of uninterrupted basic education involving 6 years of primary and 3 years of junior secondary education, 3 years of senior secondary and 4 years of tertiary education) system of education. Imam (2012) notes that the 2004 revision which retained the 9-3-4 school system is the 4th; while FRN (2013) observed that the 2007 NPE revised the 2004 edition to accommodate changes driven by the nations commitment to implement international protocols (e.g., Education for All {EFA}, the United Nations Millennium Development Goals {MDGs}) and the National Economic Empowerment and Development Strategy (NEEDS) which started in 2004. Similarly, the 2013 revision of the NPE updated the 2007 edition by accommodating the human capital development strategic goal and other transformation agenda initiated by the FGN in 2011 (FRN, 2013). It also brought the programme of early childhood care education (ECE) under the Basic Education in Section 2 and divided the ECE into two programmes namely Early Childhood Care, Development and Education (ECCDE) and Kindergarten Education (Akinrotimi & Olowe, 2016).

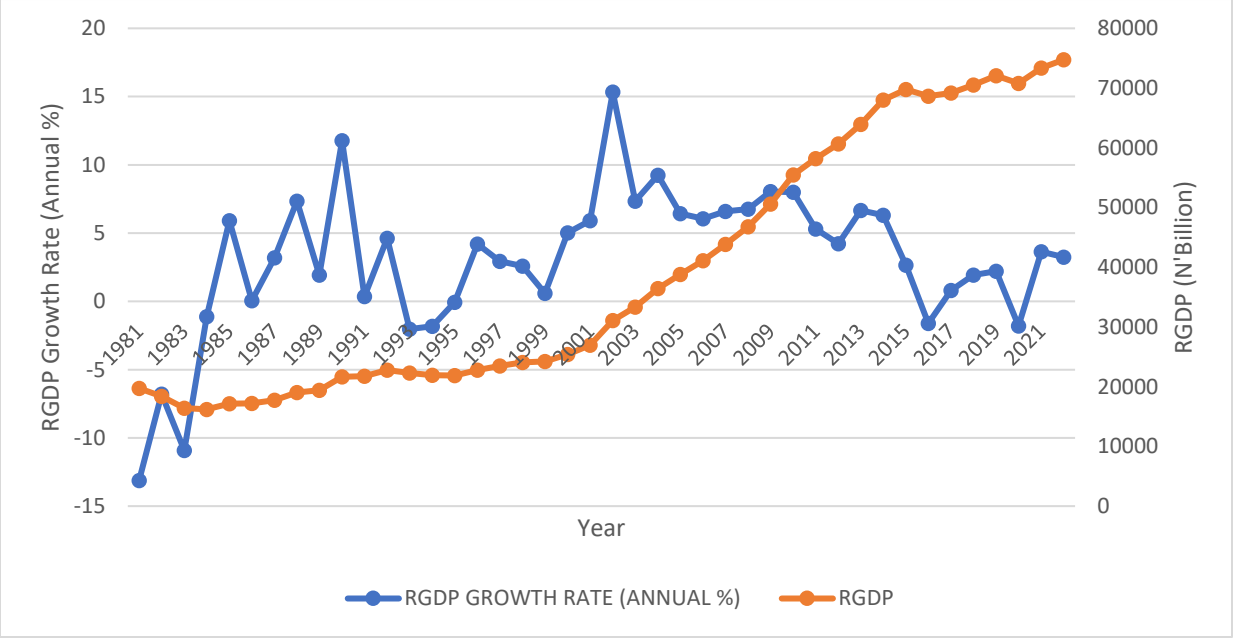
Stylized facts about RGDP and formal education in Nigeria

Let us look at some stylized facts about RGDP and formal education in Nigeria. It is a well-established fact in economic literature that a stable and satisfactory rate of economic growth is one of the four main objectives of macroeconomic policy of every country including Nigeria (Mulhearn & Vane, 1999). But over the years, the value of RGDP of Nigeria has been low, though with rising and falling trends, and the actual growth rate of RGDP has fallen below the targeted growth rate on most occasions as shown in Figure 1.

Trends of primary, secondary and tertiary school enrolment ratios and adult literacy rate in Nigeria for selected years between 1981 and 2020 are presented in Figure 2. Figure 2 shows that Nigeria has made remarkable efforts towards improving primary school enrolment over the years when compared with enrolment at secondary and tertiary levels, though with upward and downward trends. Primary, secondary and tertiary enrolment ratios stood at 103.04%, 17.09%, and 2.32% respectively in 1981. Primary school enrolment ratio declined to 89.24% in 1995,

while secondary and tertiary enrolment ratios increased to 26.91% and 5.26 respectively, but still less than primary enrolment by a very wide margin. With the implementation of Universal Basic Education Policy by many SSA countries including Nigeria coupled with the Dakar World Education Forum in 2000 which affirms Education For All (EFA) and the race to actualize MDG 2 by 2015, the primary enrolment ratio in Nigeria accelerated to 85.07% in 2010 which led to remarkable increases in both secondary and tertiary enrolment ratios to 44.19% and 9.56% in the same year. Enrolment ratios at primary, secondary and tertiary levels improved remarkably in 2015 hitting 95.01%, 46.75% and 23.53% respectively.

Figure 1: Trends of RGDP and RGDP growth rate in Nigeria (1981-2022)



Source: CBN Statistical Bulletin (2023) and World Development Indicators, WDI (2023)

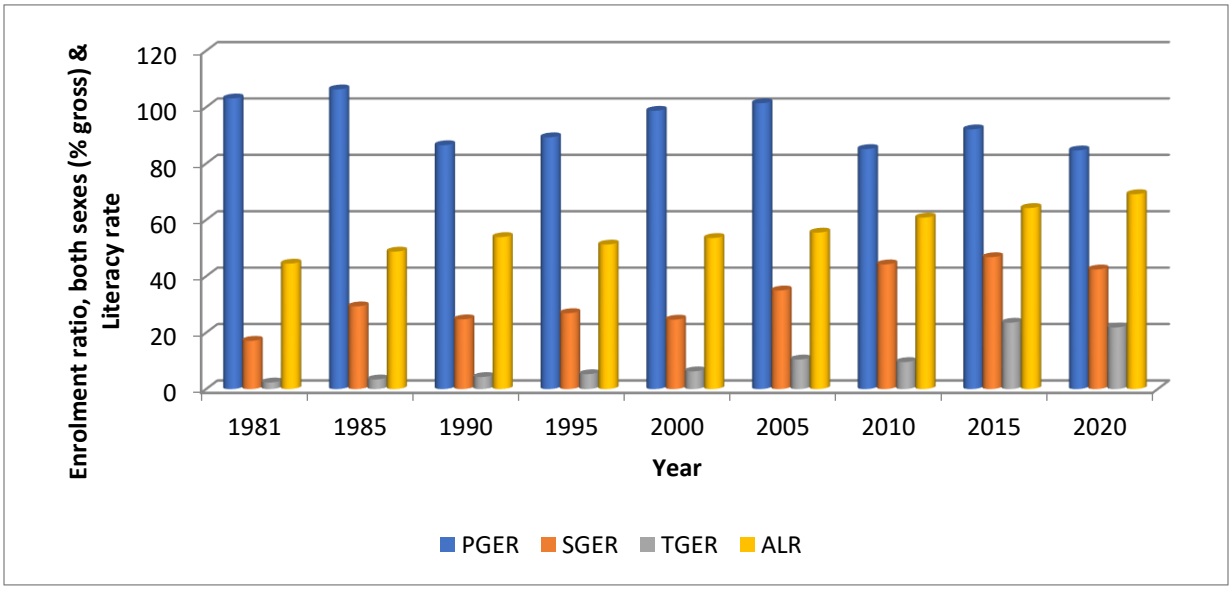
With the establishment of the National Commission for Mass Literacy, Adult and Non-formal Education, the National Minimum Standards and Establishments of Institution Amendments Decree, which provides for religious bodies, non-governmental organisations and private individuals to participate in the provision of tertiary education, the adult literacy rate improved to 69.10% in 2020.

Despite the struggle to accomplish SDG 4 by 2030, primary and secondary school enrolment ratios declined to 68.3% and 36.7% respectively, in 2019. This may be attributed to the outbreak of the COVID-19 pandemic and the outcome of poor education funding seen in Figure 3 as empirical evidence (Anyanwu & Erhijakpor, 2007) has established a positive and significant relationship between education funding and enrolment rates and vice versa. This

necessitates the need for the government of Nigeria to improve on education funding. Without this, the dream of actualizing SDG 4 (i.e., to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all by 2030) by the country will evaporate. From the figure, the primary school enrolment ratio is higher than the secondary and the tertiary school enrolment ratios because many poor families in Nigeria cannot afford secondary and tertiary education for their children, especially for the girl child. Similarly, the secondary enrolment ratio is higher than the tertiary enrolment ratio as shown by the wide gaps between the three levels of education in Nigeria.

The rising and falling trends in Figure 3 depict inconsistent commitment of the Federal Government of Nigeria to funding education over the years, which is necessary for the production of a quality labour force. In 1981, for example, government recurrent expenditure on education, government capital expenditure on education, and total government expenditure on education as a percentage of RGDP in Nigeria stood at ₦0.17 billion, ₦1.30 billion, and 0.007%.

Figure 2: Trends of primary, secondary and tertiary school enrolment ratios (% gross) and adult literacy rate in Nigeria.



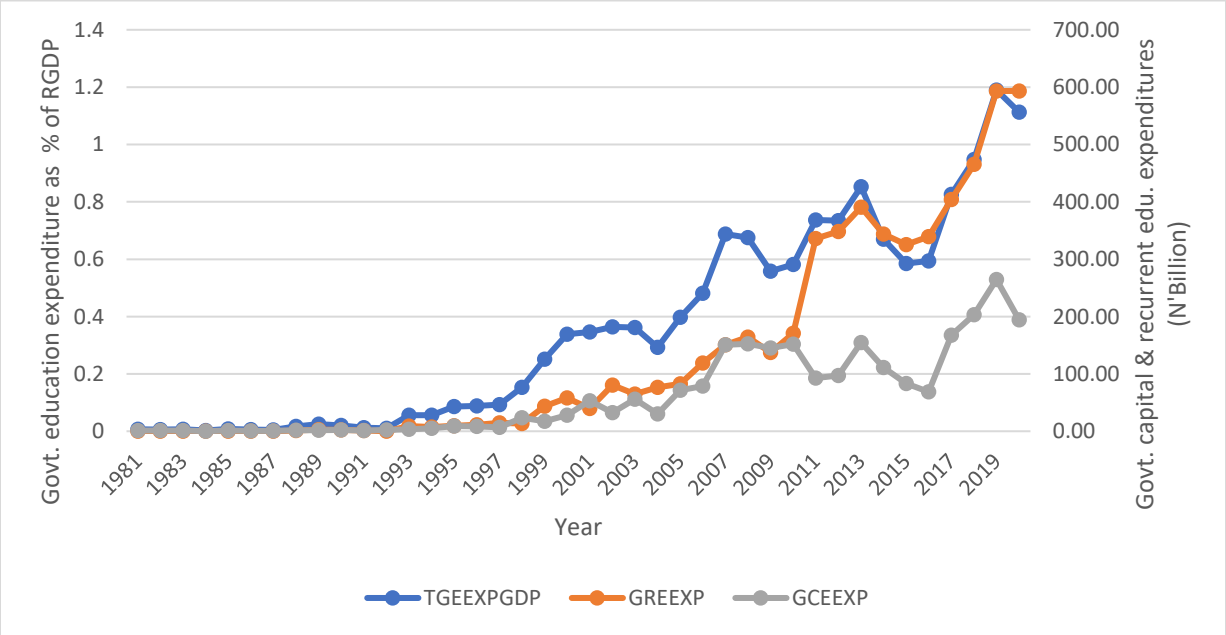
Source: Nigeria Digest of Education Statistics, NDES (2023), National Bureau of Statistics, NBS (2023), UNESCO Institute for Statistics, UIS (2023) and WDI (2023); Note: PGER = primary school gross enrolment ratio; SGER = secondary school gross enrolment ratio; TGER = tertiary school gross enrolment ratio; ALR = adult literacy rate.

This narrative remained almost the same after the adoption of the Structural Adjustment Programme (SAP) in 1986, as recurrent and capital expenditure leap-frogged to ₦0.23 billion

and ₦0.62 billion respectively. With the institutionalization of the National Economic Empowerment and Development Strategy (NEEDS), which greatly emphasized education as a veritable tool for development and further revision of the NPE in 2004 and 2007 to improve the quantity and quality of education, recurrent and capital expenditures on education improved significantly to ₦150.78 billion and ₦150.9 billion respectively, in 2007.

With further revision of the NPE in 2013, recurrent expenditure on education witnessed remarkable increases and climaxed at ₦593.44 billion in 2020 despite the outbreak of the COVID-19 pandemic in December 2019 and its attendant lockdown in 2020. Capital expenditure on education increased to ₦264.69 in 2019 but dwindled to ₦194.41 in 2020. The decline may be attributed to the COVID-19 lockdown which hindered many public capital investment projects. Total government education expenditure as a percentage of RGDP continued its traditional marginal rising and falling to 1.11% in 2020. This poor education expenditure made the achievement of the two MDGs on education (i.e., all children to complete primary school by 2015 and to achieve gender equality at all levels of education by 2015) a mirage in Nigeria. Several countries are working hard to achieve the 2030 Sustainable Development Goals (SDGs), which was adopted at the 70th Session of the United Nations General Assembly in 2015 to replace the defunct MDGs. The achievement of inclusive and equitable quality education and promotion of lifelong learning opportunities for all by 2030 (that is, SDG 4) may elude Nigeria if the Nigerian government continues its poor education expenditure pattern.

Figure 3: Trends of government education expenditure in Nigeria (1981-2020)



Source: CBN (2021) and WDI (2021); Note: TGEEXPGDP = total government expenditure on education as percentage of GDP; GREEXP = government recurrent expenditure on education; GCEEXP = government capital expenditure on education.

Empirical review

Empirically, some studies, such as Omondi (2014) for Kenya, Adu and Denkyirah (2017) for Ghana, Mendy and Widodo (2018) for Indonesia, Ali and Hassan (2021) for Pakistan, have examined the nexus between formal education and economic growth using OLS, ARDL, two-stage least squares (2SLS), and GMM estimators. Omondi (2014) established a significant positive impact of primary, secondary and university enrolments on real GDP. Adu et al. (2017) found a positive impact of primary and tertiary school enrolment rates and government education expenditure on per capita GDP, whereas that of secondary school enrolment rate was negative in the short-run. Long-run results reveal that both primary and secondary enrolments made a significant positive impact on per capita GDP, while those of tertiary school enrolment and government expenditure on education were insignificantly positive and negative respectively. Mendy et al. (2018) established a significant positive impact of primary, secondary and tertiary school enrolments on GDP in both short-run and long-run, except secondary enrolment, which turned negative in the long-run. Ali et al. (2021) reveal that primary and secondary school enrolments made a significant positive impact on the RGDP of Pakistan. Sebki (2021) conducted a cross-country analysis of the educational levels-economic growth nexus in developing countries using generalised method of moment estimators and panel data spanning 2002 to 2016. The results show that the secondary education enrolment ratio has a significant negative impact on the growth rate of RGDP, while the higher education enrolment ratio has a significant positive impact on the growth rate of RGDP in both short-run and long-run. Alfoul et al. (2024) examined the moderating role of institutional quality on the education-economic growth nexus in Sub-Saharan Africa (SSA) by applying panel ARDL model to data from 18 SSA countries covering 2000 to 2020. Findings indicate an insignificant long-run effect of education proxy by secondary school enrolment on economic growth proxy by GDP growth rate which the study attributed to high rates of education exclusion and low-quality education. However, the study established significant positive impact of education on GDP in most of the countries when the moderating role of institutional quality was estimated, suggesting that robust institutions build a crucial infrastructure that promotes the effectiveness of education in driving productivity and fostering economic growth.

In Nigeria, several studies have provided empirical evidence on the education-growth nexus. Omojimite (2010) found a unidirectional causality from public expenditures on education to economic growth, while the disaggregated results indicate a bidirectional causality between public recurrent expenditure on education and economic growth, no causality between capital

expenditure on education and economic growth, and between primary school enrolment and economic growth. The study applied the Granger causality test through annual time series data spanning 1980 to 2005, and suggested improved funding of the education sector and a revision of the primary school curriculum to make it more relevant to the needs of the Nigerian society. In another investigation by Yusuf (2014), the author disclosed that post-primary school enrolment, capital and recurrent expenditures on education made a significant positive impact on GDP per capita in the long-run, with no short-run causality among these variables in Nigeria, using the vector error correction model and secondary annual time series data from 1975 to 2012. Obi and Obi (2014) studied the impact of government education expenditure on economic growth in Nigeria by applying Johansen's cointegration analysis and ordinary least squares technique to annual time series data spanning 1981 to 2012. The OLS analysis indicates a significant positive impact of education expenditure on the index of domestic output (GDP) used to proxy economic growth, while cointegration analysis reveals no long-run relationship between education expenditure and GDP in Nigeria. The study recommended reformation of education policies through accountability and transparency in funding education projects. Applying the vector error correction technique through annual time series data spanning 1980 to 2015, Emediegwu and Clement (2016) found that budget allocation to education and primary education enrolment impacted positively on the real growth rate of GDP, while that of post-primary education enrolment impacted negatively. The study concluded that education was a significant driver of economic growth in Nigeria and recommended for prioritisation of education in the nation's developmental strategies. Aigbedion, Iyakwari and Gyang (2017) empirically investigated the impact of the education sector on economic growth in Nigeria using ordinary least squares multiple regression analysis and secondary time series data covering the period of 1980 to 2014. Findings reveal that secondary school enrolment and government expenditure on education made a positive and negative impact on RGDP respectively, whereas primary and tertiary institution enrolments, total numbers of primary, secondary and tertiary institutions, made an insignificant positive impact on RGDP in Nigeria. The study suggested that the government through budget planning, implementation and monitoring, should ensure that education funds are properly and fully utilised to improve the impact of the education sector on economic growth in Nigeria. Ayeni and Omobude (2018) investigated the nexus between education and economic growth in Nigeria using ARDL and data spanning 1987 to 2016. Findings of model one reveal that recurrent expenditure on education made a significant positive impact on RGDP in both short-run and long-run, whereas capital expenditure on education had an insignificant positive impact on RGDP. Results of model two indicate that recurrent expenditure on education had a negative and insignificant impact on education sectoral output, while capital expenditure on education had an insignificant positive impact on education sectoral output. Omodero and Nwangwa (2020) investigated the direction of causality between higher

education and economic growth in Nigeria using the Granger causality test and annual data between 2000 to 2018. Findings indicate no causality between expenditure on education and GDP, and between higher education gross enrolment ratio and GDP. Applying ARDL to time series data spanning 1987 to 2017, Nenbee and Danielle (2021) examined the nexus between education and economic growth in Nigeria. Long-run result indicates that primary and secondary school enrolment ratios and public expenditure on education had positive impact on RGDP. Short-run result reveals that the secondary school enrolment ratio had a significant positive impact on RGDP, whereas the primary school enrolment ratio and public expenditure on education had a negative impact on RGDP, with the latter being significant. Keji (2021) examined the nexus between human capital and economic growth in Nigeria. Findings indicate that in the short-run, total labour and gross capital formation impacted positively on gross domestic product growth rate, with the former being significant, whereas labour participation rate, student enrolment and government expenditure impacted negatively on GDP, with labour participation rate and government expenditure being significant. Long-run result reveals that school enrolment, labour force and government expenditure had a positive impact on GDP, while total labour force and gross capital formation had a negative impact on GDP on average, with all the variables being significant. The study suggested that the government should establish special agencies with the obligation of improving the skills and capabilities of students who form the labour force with time across all levels of education in Nigeria, in order to sustain long-run economic growth.

3 Methodology and Data

The endogenous growth theory forms the theoretical framework of the study. The endogenous growth theory asserts that economic growth is mainly the outcome of internal factors, rather than exogenous factors. It posits that innovations and investments in human capital lead to improvements in productivity. It emphasises the efficacy of policy measures in driving the long-run growth rate of an economy. The endogenous growth model suggests that the total output of an economy (Q) at any time ($_t$) depends on the total physical capital (P_t), the total human capital (H_t) and the total labour employed (E_t). The model, which is of the Cobb-Douglas production function, assumes constant returns to the individual factors and increasing returns to scale, and can be stated as:

$$Q_t = TP_t^{\alpha} E_t^{\beta} H_t^{\lambda} \quad (1)$$

where Q_t denotes real output; P_t implies physical capital; E_t means labour employed; H_t is total amount of human capital; T is the technology parameter; t is the time subscript; and α, β, and λ are parameters to be estimated. The human capital equation is stated as:

$$H_t = AD_t E_t \quad (2)$$

where AD_t is the mean years of schooling or educational attainment per worker employed. Substituting equation (2) into equation (1), gives:

$$Q_t = TP_t^{\alpha} E_t^{\beta} (AD_t E_t)^{\lambda} \quad (3)$$

$$Q_t = TP_t^{\alpha} E_t^{\beta} E_t^{\lambda} AD_t^{\lambda} \quad (4)$$

$$Q_t = TP_t^{\alpha} E_t^{\phi} AD_t^{\lambda} \quad (5)$$

A linear transformation of equation (5), taking natural logarithms, gives us:

$$\ln Q_t = \ln T + \alpha \ln P_t + \phi \ln E_t + \lambda \ln AD_t + \mu_t \quad (6)$$

where ln denotes the variables in their natural logarithms, μ_t is the stochastic error term.

Equation (6) is the basic model that enables the present study to relate RGDP to the different education proxies. The extended model in equation (7) captures objective 1 and additional control variables depicting the peculiarities of the Nigerian economy.

$$LNRGDP_t = \beta_0 + \beta_1 CEIND_t + \beta_2 NPE_t + \beta_3 ETECH_t + \beta_4 LNGFCF_t + \beta_5 PGR_t + \beta_6 IQG_t + \beta_7 INFR_t + \beta_8 TOPEN_t + \beta_9 EXR_t + \mu_t \quad (7)$$

Where

LNRGDP is real gross domestic product in its natural logarithm. This is the dependent variable which is affected by changes in the explanatory and control variables. It is measured in billion naira. Real economic growth, as expressed by real gross domestic product has been studied quantitatively since Simon Kuznets's work on accounting of national income and aggregate factor inputs in the 1950s. Government can use RGDP to understand how the economy is growing as it excludes the impact of rising prices. RGDP was also employed as the dependent variable by Pegkas (2014) and Reza and Widodo (2013) whose studies focused on Greece and Indonesia respectively.

CEIND is composite formal education index. This entered into the model as a core explanatory variable. The CEIND was developed using Principal Component Analysis (PCA) to aggregate multiple indicators of formal education into a single composite measure, thereby reducing dimensionality and mitigating multicollinearity. The indicators selected include: primary school gross enrolment ratio (PSGER); secondary school gross enrolment ratio (SSGER); tertiary school gross enrolment ratio (TSGER); adult literacy rate (ADLR); primary school years of schooling (PSYS); secondary school years of schooling (SSYS); tertiary school years of schooling (TSYS); primary school completion rate (PSCR); LSSCR = lower secondary school completion rate; and upper secondary school completion rate. These variables were standardized using z-scores to ensure comparability across different scales. PCA was then applied to the standardized data, and the first principal component—which explained the largest share of variance—was retained as the basis for the index. The factor loadings from this component served as weights for each indicator in constructing the CEIND. The composite

scores were subsequently normalized using min-max scaling to produce an index ranging from 0 to 1, facilitating interpretation. Higher CEIND values indicate stronger overall performance in formal education. This approach ensures that the index captures both access, attainments and quality dimensions of education in Nigeria while maintaining statistical rigor. Details of the PCA results, including eigenvalues, variance explained, and loadings, have been added to the revised for transparency (See Appendix 1 for details). Though with modification in its computation, this measure for education was used by Afzal, Malik, Begum, Sarwar and Fatima (2012) in the case study of Pakistan; and Afzall, Shafiq, Ahmed, Qasim and Sarwar (2013) in the case study of South Asian countries of Bangladesh, India, Pakistan and Sri Lanka. Also, Reza and Widodo (2013) attempted to estimate the composite impact of education on real GDP in Indonesia using average educational level per worker as a proxy. It is expected that CEIND would impact positively on RGDP based on the endogenous growth theory.

NPE is a dummy variable used to capture changes in the National Policy on Education. In constructing the education policy dummy, the study used 1 to denote each of the years that witnessed changes in the NPE (i.e., 1981, 1998, 2004, 2007 and 2013) and zero for the years without change in the NPE in Nigeria. Previous studies ignored this variable and it is one of the variables used in this study to fill identified knowledge gap. This study hypothesizes a positive relationship between NPE and RGDP in Nigeria.

ETECH is electric power consumption (kwh per capita) in Nigeria was used to proxy the technology parameter in the endogenous growth model because Nigeria is a developing country without any well-known developed technology with available data. Energy consumption is a vital factor in growth analysis due to its complementary role to capital and labour as indispensable inputs of production. Electricity is one of the major sources of energy driving production and facilitating services in Nigeria (Akomolafe & Danladi, 2014). It is a flexible source of power and light which is highly demanded for modern life especially driven by extensive urbanisation and modernisation, industrialisation, population growth, rising standard of living, among others. Private and public firms, industries, organisations, corporate bodies as well as academic institutions in Nigeria utilise electric power and light for their various productive ventures. Though studies recovered on Nigeria as well as other African countries on formal education-economic growth nexus did not include the technology variable, Adegoriola and Agbanuji (2020) used this variable and established both significant positive and insignificant negative impact on GDP growth rate in the short-run and the long-run respectively. ETECH is expected to impact positively on RGDP in this study.

LNGFCF is gross fixed capital formation expressed in its natural logarithm, a proxy for physical capital, following the endogenous growth model. Gross fixed capital formation is the acquisition of physical assets used in production such as buildings, machinery, and intellectual property products (CBN, 2023). GFCF used in this study is measured in billion naira. Omondi

(2014) and Mendy and Widodo (2018) whose works focused on Kenya and Indonesia respectively included GFCF in their models. Both studies established a significant positive relationship between GFCF and GDP. This study hypothesizes a positive nexus between GFCF and RGDP.

PGR is population growth rate, a proxy for labour force following the endogenous growth model. PGR entered into the model as a control variable. It refers to the annual rate of increase in the number of all residents regardless of legal status and citizenship (WDI, 2020). The study hypothesized a positive relationship between population growth rate and economic growth. Ogunleye, Owola and Mubarak (2018) utilised PGR and revealed a positive relationship between population growth and economy growth (RGDP) for Nigeria between the periods 1981 to 2015.

IQG is institutional quality proxy by quality of government. This variable entered the model as a control variable. Studies like Alfoul et al. (2024), Gasimov, Asgarzade, and Jabiyev (2023), Utile, Ijirshar and Sem (2021), and Valeriani and Peluso (2011) emphasised the importance of institutional quality in fostering economic growth. This study hypothesizes positive or negative impact of IQG on RGDP as good institutions and governance influence effective education delivery and performance, and vice versa.

INFR is inflation rate. Inflation entered into the model as a control variable. INFR is proxy by consumer price index (CPI) measured in percentage, which is the traditional proxy for inflation in most economic research as the data is readily available. This study hypothesizes an indeterminate relationship between inflation and RGDP as moderate inflation below 3% stimulates growth while high inflation rate retards growth. Idris and Bakar (2017) concluded that the inflationary trend in Nigeria is negatively affecting the realization of sustainable growth and development in Nigeria, while Olu and Idih (2015) revealed a positive but non-significant relationship between inflation and economic growth between the period 1980 and 2013.

TOPEN is trade openness. It enters the model as a control variable because Nigeria interacts with other economies in international trade. TOPEN is computed as the summation of exports and imports divided by GDP, that is, $TOPEN = \frac{\exp orts + imports}{GDP}$. Ijirsha (2019) emphasised the role of trade openness in fostering economic growth. This study expects a positive impact of TOPEN on RGDP.

EXR is exchange rate. It is a control variable as exchange rate has become an important variable in economic prosperity of every nation as no country exists in autarky nowadays. Egbaseimokumo (2025) emphasized the importance of exchange rate in growth model.

μ_t is the stochastic error term while t is a subscript indicating time. β_0 = constant, β_1, β_2, …, β_9, = parameter estimates. Based on a priori expectation, $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$, $\beta_5 > 0$, $\beta_6 > 0$ or < 0, $\beta_7 > 0$ or < 0, $\beta_8 > 0$, $\beta_5 < 0$. The study utilised secondary annual time series data covering the period of 1981 to 2020, selected based on the availability of data on the modelled

variables. Table 1 presents the summary of the variables, measurements and the specific sources of data used for each of the variables.

Table 1: Summary of the variables, measurement and data sources

Variables	**Measurement**	**Source(s)**
Real gross domestic product (RGDP)	GDP at 2010 constant market prices (₦'Billion)	CBN Statistical Bulletin (2023)
Composite formal education index (CEIND)	Primary, secondary and tertiary school enrolment ratios (% gross); primary and secondary school completion rates; primary, secondary and tertiary school mean years of schooling; and adult literacy rate (% of people 15 and above)	Researchers' computation using principal component analysis (PCA) technique and data from National Bureau of Statistics (NBS) (2023), Nigeria Digest of Education Statistics (NDES) (2023), and World Development Indicators (WDI) (2025)
Changes in National Policy on Education (NPE)	Dummy variable constructed by the researcher. 1 for a year with changes in the National Policy on Education (NPE) and 0 for a year without changes in the NPE	Researcher's construct, 1 for a year with change in the NPE and 0 for a year without change in the NPE
Electric power consumption (ETECH)	Electric power consumption (kwh per Capita)	WDI (2025)
Gross fixed capital formation (GFCF)	Gross fixed capital formation (₦'Billion)	CBN Statistical Bulletin (2023)
Population growth rate (PGR)	Population growth rate (annual %)	WDI (2023)
Institutional quality (IQG)	Quality of government	ICRG (2025)
Inflation rate (INFR)	Inflation, consumer prices (annual %)	WDI (2025)
Trade openness (TOPEN)	Sum of exports and imports divided by GDP in (₦'Billion)	Researchers' computation using data from CBN (2023)
Exchange rate (EXR)	Official exchange rate (LCU per US$, period average)	WDI (2025)

Source: Researchers' Compilation (2025)

This study adopted the autoregressive distributed lag (ARDL) estimation technique developed by Pesaran, Shin and Smith (2001) for the analysis of data in order to achieve its objective one. The (ARDL) technique is preferred to the conventional OLS multiple regression analysis, the Engle-Granger static procedures, and the Johansen cointegration analysis because of its superiority. The OLS multiple regression analysis estimates variables that are stationary at levels only, while the Johansen cointegration estimates variables that are stationary at first difference only. But the ARDL approach is suitable for estimating variables that are stationary at levels, at first difference and both levels and first difference. Additionally, it has the capacity to estimate both short-run and long-run coefficients. The justification for the use of the ARDL estimation technique in this study is that it is the best approach for our finite sample size (1981-2020), and the variables are stationary at both levels and first difference. To investigate the existence of cointegration between RGDP and the independent variables, the ARDL bounds cointegration test incorporating the National Policy on Education was adopted. To capture short-run and long-run impacts of formal education variables on RGDP and the error correction term, equation (7) is compactly re-specified in ARDL form in equation (8).

$$\Delta LNRGDP_t = \beta_0 + \beta_1 LNRGDP_{t-1} + \beta_2 CEIND_{t-1} + \beta_3 NPE_{t-1} + \beta_4 ETECH_{t-1} + \beta_5 LNGFCF_{t-1}$$
$$+\beta_6 PGR_{t-1} + \beta_7 IQG_{t-1} + \beta_8 INFR_{t-1} + \beta_9 EXR_{t-1} + \beta_{10} BRK2011_{t-1} + \beta_{11} BRK2016_{t-1} +$$
$$\sum_{j=0}^{k} \psi_{1j} \Delta LNRGDP_{t-j} + \sum_{j=0}^{k} \psi_{2j} \Delta CEIND_{t-j} + \sum_{j=0}^{k} \psi_{3j} \Delta NPE_{t-j} + \sum_{j=0}^{k} \psi_{4j} \Delta ETECH_{t-j} +$$
$$\sum_{j=0}^{k} \psi_{5j} \Delta LNGFCF_{t-j} + \sum_{j=0}^{k} \psi_{6j} \Delta PGR_{t-j} + \sum_{j=0}^{k} \psi_{7j} \Delta IQG_{t-j} + \sum_{j=0}^{k} \psi_{8j} \Delta INFR_{t-j} + \sum_{j=0}^{k} \psi_{9j} \Delta TOPEN_{t-j}$$
$$+\sum_{j=0}^{k} \psi_{10j} \Delta EXR_{t-j} + \sum_{j=0}^{k} \psi_{11j} \Delta BRK2011_{t-j} + \sum_{j=0}^{k} \psi_{12j} \Delta BRK2016_{t-j} + \sum_{j=0}^{k} \psi_{13j} \Delta ECT_{t-j}$$

(8)

where the variables are as defined above, $LNRGDP_{t-1}$ is the lagged value of RGDP in its natural logarithm, BRK2011 and BRK2016 in PGR and EXR are policy dummies identified by Zivot-Andrews breakpoint unit root test in 2011 and 2016 respectively (note that NPE captured most other structural breaks), β_0 is the constant whereas β_1, β_2, …, β_{11}, are the long-run coefficients, ψ_1, ψ_2 ,..., ψ_{13} are the short-run coefficients, ECT is the error correction term, Δ is difference operator, and k is the optimal lag length.

Tracing causal links among variables enhances understanding of policy implications towards empirical findings (Shahbaz et al., 2013). Hence, the study investigates the causal link between education variables and RGDP using the Toda-Yamamoto causality test developed by Toda and Yamamoto (1995, hereafter TY) and utilized in Salahuddin and Gow (2019) and Wolde-Rufael (2009). Taking a cue from Rambaldi and Doran (1996) and Sinha and Sinha

(2007), the TY causality test is valid for series that are integrated or cointegrated and serves also as an augmented Granger causality test and is formulated as follows: Let dmax = maximum order of integration in the VAR system below: The VAR (c + dmax) shall be estimated to use the modified WALD test for linear restrictions on the coefficients of VAR which follows an asymptotic χ^2 distribution. Using the Schwarz-Bayesian Information Criteria (SBC). To increase the number of lags in the WALD model up to the maximum cointegration level of variables entered in the model is crucially fundamental in opting for the TY causality testing procedure. The TY approach is an alternative causality testing approach based on the Granger causality equation but augmented with extra lags determined by the potential order of integration of the series causally tested. Adopting the seemingly unrelated regression analytical system, the study investigates the specified VAR four.

$$\begin{bmatrix} LNRGDP_t \\ CEIND_t \\ NPE_t \\ ETECH_t \end{bmatrix} = D_0 + D_1 \sum_{i=1}^{4} \begin{bmatrix} LNRGDP_{t-1} \\ CEIND_{t-1} \\ NPE_{t-1} \\ ETECH_{t-1} \end{bmatrix} + D_2 \sum_{i=0}^{4} \begin{bmatrix} LNRGDP_{t-2} \\ CEIND_{t-2} \\ NPE_{t-2} \\ ETECH_{t-2} \end{bmatrix} + D_3 \sum_{i=0}^{4} \begin{bmatrix} LNRGDP_{t-3} \\ CEIND_{t-3} \\ NPE_{t-3} \\ ETECH_{t-3} \end{bmatrix} + D_4 \sum_{i=0}^{4} \begin{bmatrix} LNGDP_{t-4} \\ CEIND_{t-4} \\ NPE_{t-4} \\ ETECH_{t-4} \end{bmatrix} + \begin{bmatrix} \mu_t^{LNRGDP} \\ \mu_t^{CEIND} \\ \mu_t^{NPE} \\ \mu_t^{ETECH} \end{bmatrix} \quad (9)$$

The null hypothesis of causality between CEIND and LNRGDP is Dij = 0; the alternative hypothesis is Dij ≠ 0, where Dij shows the coefficients of the variables.

4. Results and Discussion

This section presents the results of data analysis and their discussion. The analysis started with the descriptive statistics to ensure an accurate understanding of the behaviour of the employed dataset and to bolster confidence in the policy inferences arising from the analysis. The summary of the descriptive statistics is presented in Table 2.

A careful observation of Table 2 shows that the composite formal education index, National Policy on Education, population growth rate and institutional quality datasets cluster around their sample means as indicated by the proximity of their means and median values, and their small standard deviation values. This suggests the absence of outliers in the series. Conversely, real gross domestic product, electric power consumption, gross fixed capital formation, inflation rate, trade openness, and exchange rate datasets have wide gaps between their mean and median and high standard deviation values. This indicates the presence of outliers in the series. The skewness which measures the degree of asymmetry of the series shows positive skewness for all the series. The kurtosis which measures how much of the values of a distribution can be found in the tails indicates that RGDP, CEIND, ETECH, PGR, TOPEN, and EXR are platykurtic, given their kurtosis values of less than 3. IQG is mesokurtic given its kurtosis value of 3.182499 whereas NPE, GFCF and INFR are leptokurtic, given their kurtosis values of higher than 3. The probability values of the Jarque-Bera statistics indicate that RGDP, CEIND, ETECH, PGR, IQG, TOPEN, and EXR are normally distributed since their p-values are greater than 0.05

whereas NPE, GFCF and INFR are not normally distributed since their Jarque-Bera p-values are less than 0.05. There are forty observations for each variable. The graphical trend analysis of the individual variables is presented in Figure 4.

The correlation matrix which shows the degree of correlation between the variables of the model is shown in Table 3. Table 3 reveals that composite formal education index, changes in National Policy on Education, electric power consumption, gross fixed capital formation, population growth rate, trade openness and exchange rate are positively correlated with RGDP while institutional quality and inflation rate are negatively correlated with RGDP. If the correlation coefficient between any pair of regressors exceeds 0.8, then there is multicollinearity between the two variables (Gujarati and Porter, 2009). The correlation coefficients reveal that none of the independent variables are correlated at above 0.69, which implies the absence of multicollinearity among the variables. Tables 4 and 5 show the ADF, PP and Zivot-Andrews unit root test results of the variables employed by the study.

Table 2: Summary of Descriptive Statistics

	RGDP	CEIND	NPE	ETECH	GFCF	PGR	IQG	INFR	TOPEN	EXR
Mean	37243.45	0.340837	0.125000	105.8325	8598.236	2.580769	0.287052	18.99895	173.0237	100.7601
Median	26182.87	0.177206	0.000000	98.96437	8206.830	2.582495	0.277778	12.70720	110.0443	106.4643
Maximum	72094.09	1.000000	1.000000	154.1723	15789.67	2.709830	0.444444	72.83550	559.8309	358.8108
Minimum	16211.49	0.000000	0.000000	51.08055	5668.870	2.488792	0.123148	5.388008	0.867504	0.617708
Std. Dev.	20015.68	0.321775	0.334932	27.61001	1987.939	0.066333	0.081774	16.86850	170.1158	100.7283
Skewness	0.631029	0.833697	2.267787	0.148664	1.329924	0.146262	0.302326	1.823476	0.576487	0.888717
Kurtosis	1.791312	2.205197	6.142857	1.815887	5.739891	1.772824	3.182499	5.158997	2.002781	2.994774
Jarque-Bera	5.089529	5.686524	50.74830	2.484213	24.30300	2.652550	0.664850	29.93587	3.872995	5.265499
Probability	0.078492	0.058235	0.000000	0.288775	0.000005	0.265464	0.717182	0.000000	0.144208	0.071881
Observations	40	40	40	40	40	40	40	40	40	40

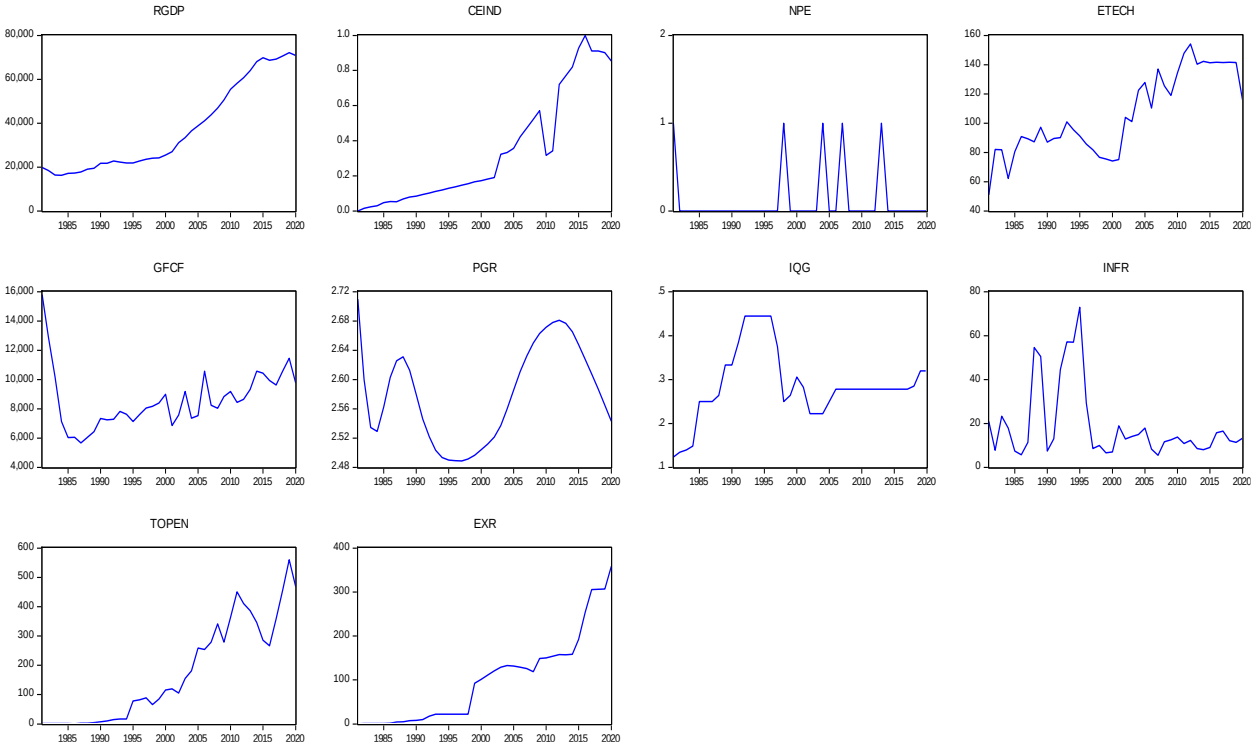
Source: Researchers' computation using Eviews; Note: RGDP = Real gross domestic product; CEIND = Composite formal education index; NPE = Changes in National Policy on Education; ETECH = Electric power consumption, GFCF = Gross fixed capital formation; PGR = Population growth rate; IQG = Institutional quality; INFR = Inflation rate; TOPEN = Trade openness; EXR = Exchange rate

Table 3: Correlation matrix

Correlation	RGDP	CEIND	NPE	ETECH	GFCF	PGR	IQG	INFR	TOPEN	EXR
RGDP	1.000000									
CEIND	0.666906	1.000000								
NPE	0.006954	0.005834	1.000000							
ETECH	0.648472	0.602210	-0.004530	1.000000						
GFCF	0.400035	0.373659	0.226472	0.153077	1.000000					
PGR	0.495338	0.413953	-0.191637	0.537555	-0.360816	1.000000				
IQG	-0.008153	-0.013409	0.266193	-0.083310	-0.391812	-0.399735	1.000000			
INFR	-0.346928	-0.321563	0.160224	-0.223445	0.275634	0.304554	-0.534780	1.000000		
TOPEN	0.644676	0.676571	-0.021640	0.663500	0.348976	0.449285	-0.008592	-0.370243	1.000000	
EXR	0.622668	0.613833	-0.049621	0.655672	0.363819	0.266021	-0.031290	-0.341839	0.697357	1.000000

Source: Researchers' computation using Eviews

Figure 4: Graphical trend analysis of the RGDP and its covariates (1981 to 2020)



Source: Researcher's computation using Eviews

Table 4: Results of ADF and PP unit root tests of stationarity

Variable	ADF Test			PP Test		
	t- statistic I(0)	t- statistic I(1)	Result	t- statistic I(0)	t- statistic I(1)	Result
LNRGDP	-1.041159	-3.783083*	I(1)	0.451047	-3.783083*	I(1)
CEIND	-0.320564	-5.930561*	I(1)	-0.214498	-5.619217*	I(1)
NPE	-7.555210*	-3.937994*	I(0)	-7.574747*	-20.70182*	I(0)
ETECH	-2.174719	-7.478639*	I(1)	-2.152015	-7.604205*	I(1)
LNGFCF	-2.404291	-5.103451*	I(1)	-3.610453**	-5.613544*	I(0)
PGR	-5.125087*	-3.058851**	I(0)	-2.403062	-4.363696*	I(1)
1QG	-2.509514	-2.771642***	I(1)	-2.234615	-4.511792*	I(1)
INFR	2.958792**	-5.752876*	I(0)	-2.827894**	-10.01334*	I(0)
TOPEN	-0.203450	-5.158102*	I(1)	0.256962	-4.994068*	I(1)
EXR	2.168856	-4.120537*	I(1)	2.403217	-4.066745*	I(1)

Source: Researchers' computation using Eviews; Note: *, **, *** implies rejection of the null hypothesis at 1%, 5%, or 10% level of significance. The test was implemented with intercept and the maximum lag length of 9 was auto-selected on SIC basis for augmented Dickey–Fuller (ADF) test and Newey–West Bandwidth employing the Bartlett–Kernel procedure for Phillips–Perron (PP).

The ADF and PP results in Table 4 reveal that the majority of the variables are stationary at first difference, I(1) while few of the variables are stationary at levels, I(0). The Zivot-Andrews unit root test with structural break in Table 5 indicates that the mid-point (break point) years are at 2004, 2013, 1998, 2004, 2001, 2011, 1997, 1995, 2005, and 2016.

Table 5: Zivot-Andrews unit root test with unknown single structural break

Variable	**Level form I(0)**			**First difference form I(1)**			
	t-Statistic	Break Date Lag		t-Statistic	Break Date Lag		Results
LNRGDP	-2.916131	2004	4	-4.988638***	2000	4	I(1) with break
CEIND	-5.652112*	2013	4	-6.231667*	2012	4	I(0) with break
NPE	-8.384042*	1998	4	-6.290714*	2008	4	I(0) with break
ETECH	-4.460320	2004	4	-8.637637*	2002	4	I(1) with break
LNGFCF	-6.387448*	2001	4	-5.606443*	1994	4	I(0) with break
PGR	-4.398053***	2011	4	-2.446218*	2012	4	I(0) with break
IQG	-3.745643*	1997	4	-5.715811*	1993	4	I(0) with break
INFR	-5.281657	1995	4	-5.758397*	2007	4	I(1) with break
TOPEN	-4.370664	2005	4	-6.573263*	2012	4	I(1) with break
EXR	-1.715613	2016	4	-5.080660*	2002	4	I(1) with break

Source: Researchers' computation using Eviews; The break locations, i.e. intercept/trend and both are denoted by the midpoint implying rejection of the null hypothesis at 10% (*); 5% (**) and 1% (***) significance levels respectively, based on percentage points of the asymptotic distribution critical values as provided by Zivot and Andrews (1992) Table.

These years are significantly policy-oriented as regards formal education as a driver of RGDP in Nigeria. For instance, in 2004, the Nigerian policy makers introduced the National Economic Empowerment and Development Strategy (NEEDS) which is a home-grown poverty reduction strategy that addresses the critical issues of improving education, infrastructure,

expansion of institutional capacity to produce quality manpower, and expansion of total school enrolment to increase the literacy level. The NEEDS also incorporates vocational and entrepreneurial skills acquisition, information communication technology (ICT), and strategies to improve the quality of technical education to meet the technical manpower needs of the economy. The structural break identified in RGDP in 2004 may be an indication that this policy influenced Nigeria's GDP growth as it aimed at promoting private sector-led growth, reforming public institutions and improving governance, liberalising markets and encouraging investment and diversifying the economy. Other policy initiatives implemented in 2004 include the banking sector consolidation which increased the minimum capital base of commercial banks from 2 billion naira to 25 billion naira leading to mergers and acquisition. This played pivotal role in stabilizing the financial system, increasing availability of credit and boosting investor confidence. The federal government also tightened fiscal discipline in 2004 through better control of public expenditure, savings from oil revenue via Excess Crude Account established in 2004 which helped to stabilize the macroeconomic environment and support economic growth. The government launched the Transformation Agenda (TA) in 2011, a new medium-term strategy with human capital development as one of the prioritised thematic areas which aligned with the defunct Vision 20: 2020 (with a focus on making the Nigerian economy one of the top 20 economies in the world by 2020). This is very significant as transformation of the population by improvement in human capital could catalyse growth. Other key thematic areas of the policy include: (i) economic growth and job creation through diversification of the economy away from crude oil, large investments in agriculture, power, infrastructure, and manufacturing; (ii) governance and public sector reform like strengthening institutions, curbing corruption and enhancing transparency, reforming the civil service for better service delivery; (iii) Infrastructure development through expanding roads, rails, and aviation networks, revamping the power sector via reforms toward privatization and increased capacity for power generation; (iv) security and social inclusion by addressing internal security challenges, reducing poverty and enhancing welfare programmes. Again, the National Policy on Education (NPE) in 2013 spelt out the prospects of early child care development, pre-primary, primary and junior secondary education. The need and prospect of senior secondary education, technical and vocational education and training and mass and nomadic education were also spelt out by the 2013 National Policy on Education. The structural break identified in exchange rate in 2016 is very significant as the Central Bank of Nigeria (CBN) formally adopted a managed floating exchange rate regime to promote efficiency and allow market forces of demand and supply exert greater influence due to persistent dollar scarcity and reserve pressures. This study captured some of these identified structural breaks in two ways (i) by constructing NPE policy dummy that used one for the years of changes in national education policy (1981, 1998, 2004, 2007, and 2013) and zero for years without a change in education policy; (ii) by incorporating another policy dummy (BRK2011) for the identified break in population growth rate as Nigeria's GDP is heavily influenced by the

quality of its labour force as a labour intensive production technique country; (iii) by incorporating an additional policy dummy (BRK2016) to capture the impact of the identified breakpoint in exchange rate as Nigeria's economic growth is heavily influenced by trade openness where exchange rate plays pivotal role.

The ADF and PP stationarity properties of the variables were validated by the Zivot-Andrews break-point unit root results of I(1) and I(0). Since the variables are stationary at the levels or first difference, the study proceeds with the co-integration test to examine the long-run relationship between the variables. Table 6 presents the autoregressive distributed lag bounds test for co-integration, and the result indicates the existence of cointegration as the F-statistic value of 5.247033 is greater than the critical upper bound value of 3.3 at the 5% level of significance.

Table 6: ARDL bounds test to cointegration

Test statistic	Value	K
F-statistic	5.247033	9
Critical Value Bounds		
Significant	I0 Bound	I1 Bound
10%	1.88	2.99
5%	2.14	3.3
2.5%	2.37	3.6
1%	2.65	3.97

Source: Researchers' computation using Eviews

Table 7 presents the ARDL short-run result while Table 8 presents the long-run result under ARDL(2,1,2,2,1,2,1,1,2,2) using the Akaike information criterion (AIC) and maximum dependent lag length of two.

Table 7: ARDL short-run estimates (Dependent variable: D(LNRGDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNRGDP(-1)	0.612997	0.212371	-2.886443	0.0148
D(CEIND)	0.123499	0.093195	1.325174	0.2120
D(NPE)	0.048160	0.023500	2.049302	0.0651
D(NPE(-1)	0.070944	0.024953	2.843065	0.0160
D(ETECH)	-0.003173	0.000841	-3.771108	0.0031
D(ETECH(-1)	-0.000815	0.000664	-1.228191	0.2450
D(LNGFCF)	-0.080517	0.077165	-1.043433	0.3191
D(PGR)	2.204140	1.126984	1.955786	0.0764

D(PGR(-1)	1.702510	0.905829	1.879506	0.0869
D(IQG)	0.054508	0.167941	0.324564	0.7516
D(INFR)	-0.001327	0.000369	-3.598573	0.0042
D(TOPEN)	0.000146	0.000200	0.732351	0.4793
D(TOPEN(-1)	-0.001018	0.000259	-3.923611	0.0024
D(EXR)	-0.000318	0.000462	-0.688058	0.5057
D(EXR(-1)	-0.001894	0.000471	-4.024693	0.0020
D(BRK2011)	0.121001	0.036951	3.274648	0.0074
D(BRK2016)	-0.003013	0.038848	-0.077546	0.9393
CointEq(-1)	-0.371594	0.139475	-2.664235	0.0220
R^2 = 0.928524; R^{-2} = 0.874066; F-statistic(p-value) =793.9030 (0.000000); Durbin-Watson = 2.06				

Source: Researchers' computation using Eviews

From the short-run result in Table 7, the coefficient of D(LNRGDP) at lag 1 is positive and significant. This implies that the dynamic regressor would increase D(LNRGDP) by 0.612997 unit in the immediate future period, all things being equal. The result shows that the composite formal education index is positive with coefficient of 0.123499. However, the coefficient is statistically insignificant at the 5% significance level implying that it does not significantly improve D(LNRGDP) in the short-run. Possible reasons for the insignificant coefficient of the CEIND in the short-run may be due to the inability of some of the educational institutions to produce graduates with appropriate knowledge and skills (Gakusi, 2010), resulting in a high level of unemployment; poor remuneration of education workers, resulting in brain drain in the system (Fiaz, 2017). It may also be attributed to fact that it takes time before the impact of education on D(LNRGDP) is felt significantly. Interestingly, the dummy used to capture structural breaks emanating from changes in the National Policy on Education (NPE) made a significant positive impact on D(LNRGDP) at the 10% level of significance in the short-run. The coefficient shows that the changes in the National Policy on Education generated 0.048160 unit increase in RGDP. Similarly, the NPE at lag 1 (NPE(-1) made a significant positive impact on D(LNRGDP) as it led to 0.070944 unit growth in RGDP. Sadly, the coefficient of electric power consumption is negative and significant at the 1% significance level, with the implication that 1% increase in the electric power consumption reduced the value of D(LNRGDP) by 0.003173 unit. Electric power consumption at lag 1 (ETECH(-1) impacted negatively but insignificantly on D(LNRGDP) with a coefficient of -0.000815. This result does not conform to a priori expectation. The possible reason for the unconformity of electric power consumption may be attributed to epileptic power supply which disrupts production in Nigeria, thus limiting its contribution to D(LNRGDP). The gross fixed capital formation made insignificant negative impact on D(LNRGDP) at 5% significance level. The possible economic

reason for unconformity of GFCF may be as a result of low capital formation in Nigeria. In fact, GFCF has been rising and falling, thus making its output contribution to D(LNRGDP) volatile and unsustainable. The population growth rate (PGR) and its lag 1 (PGR(-1) made positive and significant impact on D(LNRGDP) in the short-run at 10% significant level. Specifically, 1% increase in the PGR and (PGR(-1) improved D(LNRGDP) by 2.204140 unit and 1.702510 unit respectively. This significant positive short-run impact of PGR and the magnitude of its coefficient highlights the pivotal role of population growth as it provides adequate labour force that drives short-run output in Nigeria as labour intensive production technique is predominant, more especially, in the agricultural sector. Institutional quality (IQG) made insignificant positive impact on D(LNRGDP) with a coefficient of 0.054508, suggesting that Nigeria's IQG is not strong enough to drive growth in the short-run. This highlights the need to strengthen the quality of our institutions by eliminating corruption at all levels, reducing bureaucratic redtapism and strengthening government effectiveness. Inflation made significant negative impact on D(LNRGDP) at 1% significance level, as 1% increase in INFR reduced D(LNRGDP) by 0.001327 unit. This highlights the damaging effect of unabated inflation on economic growth in Nigeria, and the urgent need for the government to roll out monetary and fiscal measures to curb its menace. Trade openness made insignificant positive impact on D(LNRGDP) in the short-run. Its lag 1, (TOPEN(-1) turned significant and negative. The magnitude of the significant negative coefficient (0.001018) exceeds that of its insignificant positive coefficient (0.000146) in absolute term, suggesting that Nigeria's trade has not promoted its short-run growth. This may be due to high importation of consumables, luxurious cars and other unproductive commodities, and over dependence on oil exports. This highlights the need to diversify Nigeria's export base so as to promote economic growth. Exchange rate and its lag 1 have negative coefficients with the latter being significant at 1% significance level, suggesting that high exchange rate is inimical to Nigeria's growth. This highlights the need for the government to curb high exchange rate. The policy dummy for structural break in the population growth rate (BRK2011) made significant positive impact on D(LNRGDP) at 1% significance level in the short-run. Precisely, the coefficient indicates 0.121001 unit increase in D(LNRGDP). This implies that the Transformation Agenda launched by the government in 2011 impacted positively on short-run growth. The policy dummy for structural break in the exchange rate (BRK2016) made insignificant negative impact on D(LNRGDP) suggesting that the policy could not catalyse economic growth in the short-run. The error correction term, a measure of the speed of adjustment of LNRGDP from the short-run to the long-run equilibrium is well behaved, as it has a significant negative coefficient at 1% level of significance. The coefficient shows that about 37.15% deviation from the equilibrium is corrected every year to ensure convergence in the long-run.

The R-squared in the lower part of Table 7 reveals that about 92.85% of the changes in the LNRGDP are jointly explained by the independent variables of the model, whereas the

stochastic term explains the remaining 7.15%. This implies that the model is well fitted. The F-statistic value of 793.9030 and its probability value of 0.000000 are strong indicators of the overall significance of the model. The Durbin-Watson statistic of 2.065427 implies that the model is free from serial correlation. The Breusch-Godfrey serial correlation LM test which is a second order condition (SOC) test confirms this in Table 10. The long-run estimates are presented in Table 8.

Table 8: ARDL long-run estimates (Dependent variable: LNRGDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CEIND	1.298760	0.508449	2.554355	0.0268
NPE	0.019841	0.073954	0.268293	0.7909
ETECH	0.015430	0.005415	2.849563	0.0158
LNGFCF	1.160585	0.442742	2.621355	0.0238
PGR	-3.762412	2.083209	-1.806066	0.0983
IQG	-1.656682	1.074840	-1.541329	0.1515
INFR	0.000924	0.001344	0.686987	0.5063
TOPEN	0.001250	0.000450	2.779249	0.0179
EXR	-0.006194	0.003162	-1.958923	0.0760
BRK2011	-0.325626	0.171478	-1.898942	0.0841
BRK2016	0.005096	0.065656	0.077609	0.9392
C	8.213793	4.196780	1.957165	0.0762

Source: Researchers' computation using Eviews

The long-run result in Table 8 indicates that the composite formal education index made a positive and significant impact on LNRGDP at the 5% level of significance. Specifically, 1% increase in CEIND generated 1.298760 unit increase in LNRGDP. The magnitude of this long-run coefficient is an improvement over its short-run insignificant positive coefficient of 0.123499. The NPE made insignificant positive impact on LNRGDP in the long-run. The statistically insignificant coefficient implies that it failed to catalyse growth in the long-run. This suggests that some developments in the economy might have rendered the policy obsolete or there were lapses in its implementation, thus, highlighting the need for revision of the policy and strict implementation with adequate monitoring and periodic evaluations. Interestingly, electric power consumption impacted positively and significantly on LNRGDP in the long-run. Numerically, 1% increase in the ETECH promoted LNRGDP by 0.015430 unit. The magnitude of the long-run coefficient is higher than that of the short-run, and the statistically significant long-run coefficient implies that the sustained efforts of the government at improving the power sector through revamping it and the partial privatization and commercialization of the sector would yield better fruits in the long-run if sustained. Interestingly, gross fixed capital formation impacted positively and significantly on LNRGDP at 5% significance level in the long-run, an

improvement over its short-run insignificant negative impact. Precisely, 1% increase in LNGFCF generated 1.160585 unit increase in LNRGDP. Sadly, the coefficient of population growth rate turned significantly negative in the long-run at 10% significance level. The coefficient suggests that 1% increase in PGR led to 3.762412 unit decline in LNRGDP. This is a very striking finding implying that Nigeria might witness population explosion which would be inimical to output growth in the long-run. This highlights the need for the government to come up with population control measures, and also improve the GFCF of the economy to match the increasing labour force emanating from increased population growth rate. Institutional quality and exchange rate made negative impact on LNRGDP in the long-run, with the latter being significant at 10% significance level. Exchange rate reduced LNRGDP by 0.006194 in long-run. The two results imply that IQG has more capacity to hamper growth than improving it while EXR has no prospect to promote growth in the long-run, thus highlighting the need for a proactive reversal exchange rate policy and improvement in the institutional quality. Trade openness has a significant positive long-run impact on LNRGDP but its magnitude is small at 0.001250 unit. The result suggests that TOPEN has the capacity to drive growth of the Nigerian economy in the long-run if the export base is diversified, and import of unproductive consumables is restricted. Sadly, the policy dummy for structural break in the population growth rate (BRK2011) made significant negative impact on LNRGDP at 10% significance level in the long-run as it reduced LNRGDP by 0.325626 unit. This is another indication that the TA policy has no far-reaching impact on Nigeria's growth which necessitates the need for strict implementation of growth policies in Nigeria. The Economic Recovery and Growth Plan of 2017 to 2020 is gone, the ongoing National Development Plan (2021 to 2025) is almost gone. Now, Nigeria is transitioning to the Renewed Hope Development Plan (2026 – 2030) which has been approved by the National Economic Council. There is need for strict implementation of the policy designed to: (i) consolidate ongoing reforms from the current administration; (ii) achieve a one trillion-naira GDP economy by 2030; (iii) accelerate job creation, human capital development, infrastructure, food security, and social protection; (iv) provide continuity from the current development framework and link to long-term Vision Agenda 2050. The policy dummy for structural break in the exchange rate (BRK2016) made insignificant positive impact on LNRGDP suggesting that the policy could not foster economic growth in the long-run.

To determine the direction of causality between formal education variables and LNRGDP, the study carried out the Toda-Yamamoto causality test, and the result is presented in Table 9.

Table 9: Toda-Yamamoto Causality (modified WALD) Test Results

	Chi-Square (χ^2)	**Prob.**	**Conclusion**
ΔCEIND → ΔLNRGDP	7.513922	0.0234	Reject
ΔLNRGDP → ΔCEIND	3.380790	0.1844	Do not reject

ΔNPE → ΔLNRGDP	6.317627	0.0425	Reject
ΔLNRGDP → ΔNPE	0.268234	0.8745	Do not reject
ΔETECH → ΔLNRGDP	5.593542	0.0610	Reject
ΔLNRGDP → ΔETECH	16.95118	0.0002	Reject
ΔLNGFCF → ΔLNRGDP	5.722059	0.0572	Reject
ΔLNRGDP → ΔLNGFCF	1.713229	0.4246	Do not reject
ΔPGR → ΔLNRGDP	6.901384	0.0317	Reject
Δ LNRGDP → ΔPGR	11.78556	0.0028	Reject
Δ IQG → ΔLNRGDP	0.709857	0.7012	Do not reject
Δ LNRGDP → ΔIQG	0.398764	0.8192	Do not reject
Δ INFR → ΔLNRGDP	0.793890	0.6724	Do not reject
Δ LNRGDP → ΔINFR	3.061247	0.2164	Do not reject
Δ TOPEN → ΔLNRGDP	7.847861	0.0198	Reject
Δ LNRGDP → ΔTOPEN	0.028390	0.9859	Do not reject
Δ EXR → ΔLNRGDP	3.781848	0.1509	Do not reject
Δ LNRGDP → ΔEXR	0.948452	0.6224	Do not reject
Δ BRK2011 → ΔLNRGDP	6.656119	0.0359	Reject
Δ LNRGDP → ΔBRK2011	3.061247	0.2164	Do not reject
Δ BRK2016 → ΔLNRGDP	0.790015	0.6737	Do not reject
Δ LNRGDP → ΔBRK2016	2.526753	0.2827	Do not reject

Source: Researchers' computation using Eviews

The Toda-Yamamoto (TY) causality test in Table 9 reveals that there is an impact between CEIND and LNRGDP, and NPE and LNRGDP at 5% significance level, as CEIND and NPE stimulated LNRGDP to the tune of 7.513922 units and 6.317627 units respectively. This TY result corroborates the ARDL long-run result where CEIND made a significant positive impact on LNRGDP at 5% significant level, and the ARDL short-run result where NPE made significant positive impact on D(LNRGD). The TY test also established an impact between ETECH and LNRGDP, LNGFCF and LNRGDP, and PGR and LNRGDP at 10% significance level for the first two and at 5% significance level for the third. Precisely, ETECH, LNGFCF and PGR stimulated LNRGDP by 5.593542 units, 5.722059 units, and 6.901384 units respectively. This supports the ARDL long-run impact of ETECH and LNGFCF and the ARDL short-run impact of PGR where they all have significant positive coefficients. The TY reveals a feedback effect between ETECH and LNRGDP and PGR and LNRGDP and LNRGDP also stimulated ETECH and PGR by 16.95118 units and 11.78556 units respectively at 1% significance level. From the TY result, no impact was established between IQG and LNRGDP, INFR and LNRGDP, EXR and LNRGDP as their probability values are insignificant. This TY result corroborates the ARDL results as none of these variables increased LNRGDP significantly either in the short-run or long-

run. The TY causality result established an impact TOPEN and LNRGDP as TOPEN promoted growth by 7.847861 units at 1% significance level, suggesting that its ARDL long-run significant positive coefficient at 1% significance level is not a fluke. The TY result indicates an impact between BRK2011 and LNRGDP as the policy dummy stimulated growth to the tune of 6.656119 units at 5% significance level. This lends credence to its ARDL short-run significant positive impact on growth. The TY established no significant causal link between BRK2016 and LNRGDP. This finding corroborates the ARDL short-run and long-run results of BRK2016.

To ensure the validity and reliability of the model estimates for forecasting and policy formulation, the residual diagnostics and stability tests were carried out. Table 10 presents the diagnostic test results. From the insignificant p-values of all the tests, the estimates are satisfactory and the model is well-specified.

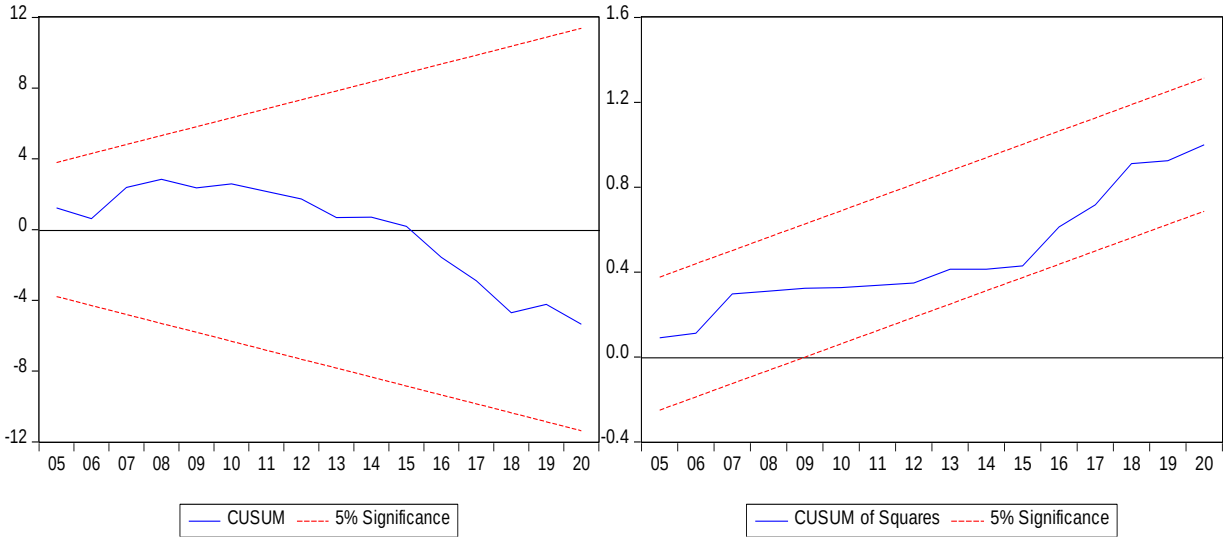
Table 10: Residual diagnostic tests

Battery of tests		**Prob.**
1	Jarque Bera Normality Test	0.712910
2	Breusch-Godfrey Serial Correlation LM Test	0.3417
3	Breusch-Pagan-Godfrey Heteroskedasticity Test	0.8605
4	Ramsey RESET Test	0.2007

Source: Researchers' computation using Eviews

The parameter stability of the estimated model is confirmed using the CUSUM and CUSUM of Squares displayed in Figure 5, which shows that the model of this study is stable within the 5 percent level of significance. Hence, it can be concluded that the results are appropriate for forecasting and policy formulation.

Figure 5: CUSUM and CUSUM of squares graphs



Source: Researchers' computation using Eviews

5. Conclusion, Policy Implications and Recommendations

This paper examines the impact of formal education on economic growth in Nigeria by applying the ARDL and Toda-Yamamoto causality test to time series data spanning 1981 to 2020. ADF, PP and Zivot-Andrews unit root tests indicate a mixture of I(0) and I(1). The ARDL bounds test for cointegration indicated the existence of a long-run relationship among the variables. Findings reveal that: composite formal education index made an insignificant positive impact on real gross domestic product (RGDP) in the short-run and a significant positive impact on RGDP in the long-run, changes in National Policy on Education impacted positively and significantly on RGDP in the short-run, and insignificantly positive in long-run. TY causality test established that both composite formal education index and changes in National Policy on Education cause economic growth without a feedback effect. On the overall, the study concludes that the formal education sector drives economic growth in Nigeria based on the ARDL and Toda-Yamamoto causality results. It can also be inferred from the empirical findings that given the performance of the control variables used to capture the peculiarities of the Nigerian economy, the endogenous growth theory which formed the theoretical framework of the study is operative in Nigeria.

The following policy recommendations are made based on the empirical findings. First, the budgetary allocation to the education sector should be stepped up from the 7.9% assigned to the education sector by the Federal Government of Nigeria in 2024 to at least the recommended 26% minimum for less developed countries by UNESCO. This is to ensure that enough funds are available for the provision of adequate teaching and learning facilities and a conducive environment for effective teaching and learning in the formal education system in Nigeria. Consequently, the quality of education and educational attainments which are drivers of RGDP

will improve. Secondly, there is a need for the government to set up a committee of stakeholders charged with the responsibility of reviewing and revising the National Policy on Education to recommend practical entrepreneurial, creative, innovative and vocational education in Nigeria. Thirdly, there should be extension of the compulsory tuition-free primary education to secondary education level, enactment of law that makes it a punishable offence for parents that fail to send their children to at least primary and secondary schools, and motivation of staff of formal education through adequate remuneration, improved welfare packages and staff development programmes in order to promote formal education for economic growth in Nigeria. Fourthly, there is need to promote science, technology, engineering, mathematics (STEM) and digital skills development as the digital economy is one of Nigeria's fastest-growing sectors. This can be achieved by: (i) integrating coding, data literacy, and digital skills into primary and secondary school curricula; (ii) establishing digital innovation hubs in federal and state universities to nurture technology talents; (iii) subsidising technology and engineering programmes to motivate enrolment of women and disadvantaged groups; (iv) promoting public-private partnerships with technology companies for curriculum design and certification. These will drive innovation, new enterprise creation, productivity, and global competitiveness in the knowledge economy.

References

Adegoriola, A. E., & Agbanuji, D. A. (2020). Impact of electricity consumption on economic growth in Nigeria. *The International Journal of Humanities & Social Sciences, 8(5), 143-150. https://doi.org/10.24940/theijhss/2020/v8/i5/HS2005-034.*

Adu, D. T., & Denkyirah, E. K. (2017). Education and economic growth: a co-integration approach. *International Journal of Education Economics and Development*, *8*(4), pp. 228-249. *https://doi.org/10.1504/IJEED.2017.10009612*

Afzal, M., Malik, M. E., Begum, I., Sarwar, K., & Fatima, H. (2012). Relationship among education, poverty and economic growth in Pakistan: An econometric analysis. *Journal of Elementary Education, 22(1), 23-45.*

Afzall, M., Shafiq, M., Ahmed, N., Qasim, H. M., & Sarwar, K. (2013). Education, poverty and economic growth in South Asia: A panel data analysis. *Journal of Quality and Technology Management, 9(1), 131-154.*

Aigbedion, I. M., Iyakwari, A. D. B., & Gyang, J. A. (2017). Education sector and economic growth in Nigeria: An impact analysis. *International Journal of Advanced Studies in Economics and Public Sector Management, 5(3), pp. 58-69.*

Akagbou, S. D. (1985). The economics of educational planning in Nigeria, India: Vikas Publishing House, PVT Ltd

Akinleye, G. T., Olowookere, J. K., & Fajuyagbe, S. B. (2021). The impact of oil revenue on economic growth in Nigeria (1981-2018). *Acta Universitatis Danubius. Œconomica*, *17*(3), pp. *317-329.*

Akinrotimi, A. A., & Olowe, P. K. (2016). Challenges in implementation of early childhood education in Nigeria: The way forward. *Journal of Education and Practice, 7(7), 33-38.*

Akomolafe, K. J., & Danladi, J. D. (2014). Electricity consumption and economic growth in Nigeria: A multivariate investigation. *International Journal of Economics, Finance and Management, 3(1), 28-33.*

Alfoul, M. N. A., Bazhair, A. H., Khatatbeh, I. N., Arian, A. G., & Al-Foul, M. N. A. (2024). The effect of education on economic growth in sub-Saharan African Countries: Do Institutions Matter?. *Economies, 12: 300*. https://doi.org/ 10.3390/economies12110300.

Anyanwu, J., & Erhijakpor, A. E. (2007). *Working Paper 92-Education Expenditures and School Enrolment in Africa: Illustrations from Nigeria and Other SANE Countries* (No. 227).

Asteriou, D., & Agiomirgianakis, G. M. (2001). Human capital and economic growth: time series evidence from Greece. *Journal of Policy Modelling*, *23*(5), pp. 481-489. https://doi.org/10.1016/S0161-8938(01)00054-0

Ayeni, A. O., & Omobude, O. F. (2018). Educational expenditure and economic growth nexus in Nigeria (1987-2016). *Journal for the Advancement of Developing Economies, 7(1), pp. 59-77. http://dx.doi.org/10.32873/unl.dc.jade7.1.5*

Babatunde, M. A., & Shuaibu, M. I. (2011). Money supply, inflation and economic growth in Nigeria. *Asian-African Journal of Economics and Econometrics*, *11*(1), pp. 147-163.

Barro, R. J., & Sala-i-Martin, X. (2004). Economic growth, 2nd ed. Cambridge: The MIT Press

Bello, J. Y. (1986). The 6-3-3-4 system: Another exercise in futility? A paper presented at the Annual Convention of the Nigeria Association of Educational Administration and Planning at the University of Port Harcourt.

Callen, T. (2012). Gross domestic product: An economy's all. Washington, DC: International Monetary Fund.

CBN (2023). Statistical bulletin. Abuja: Central Bank of Nigeria

Egbaseimokumo, O. P. (2024). The Effect of Exchange Rate on the Growth of the Nigerian Economy. *International Journal of Research and Innovation in Social Science, 8(12), 1872-1886.* https://dx.doi.org/10.47772/IJRISS.2024.8120160

Eigbiremolen, G. S. O., & Anaduaka, U. S. (2014). Human Capital Development and Economic Growth: The Nigeria Experience. *International Journal of Academic Research in Business and Social Sciences*, *4*(4), pp. 25-35. https://doi.org/10.6007/IJARB SS/ v4-i4/749

Emediegwu, L. E., & Clement, I. (2016). The connection between education and sustainable economic growth in Nigeria. *Zambia Social Science Journal*, *6*(1), pp. 65-79

Fafuwa, A.B. (1974). History of education in Nigeria. London: George Allen & Unwin.

Fiaz, M. F. (2017). Impact of brain drain on economic growth and human capital formation in Pakistan: An empirical study (Master's thesis, KDI School of Public Policy and Management)

FRN (Federal Republic of Nigeria) (2013). National policy on education (6th ed.). Yaba, Lagos: Nigerian Educational Research and Development Council (NERDC).

Gabriel, A. O. I. (2018). Trends in the implementation of Nigeria's national policy on technical and vocational education and training: 1977-2014. *International Journal of Humanities and Social Sciences (IJHSS), 7(3), pp. 71-88.*

Gakusi, A. E. (2010). African education challenges and policy responses: Evaluation of the effectiveness of the African Development Bank's assistance. *African Development Review, 22(1), pp. 208–264.*

Gasimov, I., Asgarzade, G., & Jabiyev, F. (2023). The impact of institutional quality on economic growth: Evidence from post-Soviet countries. *Journal of International Studies, 16(1), 71-82.* https://doi.org/10.14254/2071-8330.2023/16-1/5

Grant, C. (2017). The contribution of education to economic growth. UK: *Department of International Development*, Institute of Development Studies.

Gujarati, D. N., & Porter, D. C. (2009). Basic Econometrics. 5th ed. New York: McGraw-Hill/Irwin.

Idris, M., & Bakar, R. (2017). The relationship between inflation and economic growth in Nigeria. A conceptual approach. *Asian Research Journal of Arts and Social Sciences, 3(1), 1-15.*

Igbal, L., Awan, A. G., & Tayyab, M., (2018). Impact of health and education on the level of productivity: evidence from Pakistan. *Global Journal of Management, Social Sciences and Humanities, 4(4), pp.933-947.*

Ijirsha, V. U. (2019). Impact of trade openness on economic growth among ECOWAS countries:
1975-2017. *CBN Journal of Applied Statistics (JAS), 10(1), 75-96.*

Ilechukwu, L. C., Njoku, C. C., & Ugwuozor, F. O. (2014). Education and development disconnect in Nigeria: Education for sustainable development (ESD) as the 21st century imperative for Nigeria's national transformation, sustainable development and global competitiveness. *Journal of Economics and Sustainable Development, 5(23), pp. 44-56.*

Imam, H. (2012). Educational policy in Nigeria from the colonial era to the post-independence period. *Italian Journal of Sociology of Education, 4(1), 181-204.* https://doi.org/10.14658/pupj-ijse-2012-1-8.

Irigoyen, C. (2017). Universal Basic Education in Nigeria. Africa: Centre for Public Impact. https://www.centreforpublicimpact.org/case-study/universal-basic-education-nigeria

Jelilov, G., Aleshinloye, M.F., & Önder, S. (2016). Education as a key to economic growth and development in Nigeria. *The International Journal of Social Sciences and Humanities Invention, 3(2), pp. 1862-1868. https://doi.org/10.18535/ijsshi/v3i2.6*

Keji, S.A. (2021). Human capital and economic growth in Nigeria. *Future Business Journal, 7(1), pp. 1-8. https://doi.org/10.1186/s43093-021-00095-4*

Koutsoyiannis, A. (1997). Theory of econometrics. An introductory exposition of econometric methods. 2nd ed. New York: Palgrave Publishers Ltd.

Lenkei, B., Mustafa, G., & Vecchi, M. (2018). Growth in emerging economies: Is there a role for *education? Economic Modelling, 73, pp. 1-14. https://doi.org/10.1016/j.econmod.2018.03.020*

Loening, J. L. (2004). Time series evidence on education and growth: The case of Guatemala, 1951-2002. *Revista De Analisis Economico, 19(2), pp. 3-40. https://ssrn.com/abstract=1244563*

Mendy, D., & Widodo, T. (2018). Do education levels matter on Indonesian economic growth?. *Economics & Sociology*, *11*(3), pp. 133-146. *https://doi.org/10.14254/2071789X.2018/11-3/8*

Mulhearn, C., & Vane, H. R. (1999). Economics. UK: Palgrave Macmillan

National Bureau of statistics (2023). Education statistics. https://www.nigerianstat.gov.ng

Nelson, R. R., & Phelps, E. S. (1966). Investment in humans, technological diffusion, and economic growth. *American Economic Review, 56(1/2), pp. 69-75*.

Nenbee, S. G., & Danielle, I. E. (2021). Primary school enrolment, public spending on education and economic growth in Nigeria. *Mediterranean Journal of Social Sciences 12(5), pp. 103-113. https://doi.org/10.36941/mjss-2021-0048*

NERDC (Nigerian Educational Research Council) (1972). A philosophy for Nigerian education. Ibadan: Heinemann Educational Books

Ngaka, W., Openjuru, G., & Mazur, R. E. (2012). Exploring formal and non-formal education practices for integrated and diverse learning environments in Uganda. *The International Journal of Diversity in Organisations, Communities and Nations, 11(6), pp. 109-121*.

Nigeria Digest of Education Statistics, NDES (2023). Education statistics in Nigeria. Abuja: Federal Ministry of Education.

Nwangwu, I. O. (2007). Higher education for self-reliance: An imperative for the Nigerian economy. Access, equity and equality in higher education, pp.1-8.

Obi, Z. C., & Obi, C. O. (2014). Impact of government expenditure on education: The Nigerian experience. *International Journal of Business and Finance Management Research, 2*, pp. 42-48.

Ogunleye, O. O., Owolabi, O. A., Sanyaolu, O. A., & Lawal, O. O. (2017). Human capital development and economic growth in Nigeria. IJRDO-*Journal of Business Management, 3(8), pp. 17-37.*

Oketch, M., McCowan, T., & Schendel, R. (2014). The impact of tertiary education on development. A rigorous literature review. London: DFID.

Okoroma, N. S. (2000). Perspectives of educational management, planning and policy analysis. Port Harcourt: Minson Publishers.

Okoroma, N. S. (2003). Factors militating against the effective implementation of the basic education programme in Rivers State. [Unpublished Lecture Notes]

Okoroma, N. S. (2006). Educational policies and problems of implementation in Nigeria. *Australian Journal of Adult Learning, 46(2), 242-263*

Olatunji, M. O. (2018). The theory and practice of free education in Nigeria: A philosophical critique. *Journal of Education in Black Sea Region, 4(1), 135-145.*

Olu, F. J., & Idih, O. E. (2015). Inflation and economics growth in Nigeria. *Journal of Economics and International Business Management, 3(1), 20-30.*

Omodero, C. O., & Nwangwa, K. C. (2020). Higher education and economic growth of Nigeria: Evidence from co-integration and Granger causality examination. *International Journal of Higher Education, 9(3), pp. 173-182. https://doi.org/10.5430/ijhe.v9n3p173*

Omojimite, B. U. (2010). Education and economic growth in Nigeria: A Granger causality analysis. *African Research Review, 4(3a), pp. 90-108.*

Omondi, S. (2014). The effects of education on economic growth in Kenya (Master's thesis, University of Nairobi).

Onwioduokit, E. (2020). Education, inclusive growth and development in Nigeria: Empirical examination. *Bullion, 44(2), pp. 3-30.*

Oyegoke, E. O., & Aras, O. N. (2021). Impact of foreign direct investment on economic growth in Nigeria. *Journal of Management, Economics, and Industrial Organization, 5(1), pp. 31-38. https://doi.org/10.31039/jomeino.2021.5.1.2.*

Oyeleke, O. & Akinyeye, C. O. (2013). Curriculum development in Nigeria: Historical perspectives. *Journal of Educational and Social Research, 3(1), 73-80.* https://doi.org/10.5901/jesr.2013.v3n1p73

Pegkas, P. (2014). The link between educational levels and economic growth: A neoclassical approach for the case of Greece. *International Journal of Applied Economics, 11(2), 38-54.*

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics, 16(3), pp. 289-326.*

Rambaldi, A. N., & Doran, T. E. (1996). Testing for Granger non-causality in cointegrated system made easy. (Working Papers in Econometrics and Applied Statistics No. 88), Department of Econometrics, University of New England.

Reza, F., & Widodo, T. (2013). The impact of education on economic growth in Indonesia. *Journal of Indonesian Economy and Business, 28(1), 23 – 44.*

Salahuddin, M., & Gow, F. (2019). Effects of energy consumption and economic growth on environmental quality: evidence from Qatar. *Environmental Science and Pollution Research, 26, pp. 18124–18142*. https://doi.org/10.1007/s11356-019-05188-w.

Sarwar, G., Ali, M., & Hassan, N. (2021). Educational expansion and economic growth nexus in Pakistan: Instrumental variable approach. *Journal of Quantitative Methods, 5(1), pp. 1-17. https://doi.org/10.29145/2021/jqm/050101*

Schultz, T. P. (1999). Health and schooling investments in Africa. *Journal of Economic Perspectives, 13(3), pp. 67-88*

Sebki, W. (2021). Education and economic growth in developing countries: Empirical evidence from GMM estimators for dynamic panel data. *Economics and Business, 35, pp. 14–29. https://doi.org/10.2478/eb-2021-0002.*

Shahbaz, M., Khan, S., & Tahrir, M. I. (2013). The dynamic links between energy consumption, financial development and trade in China: fresh evidence from multivariate framework analysis. *Energy Economics, 40, pp. 8–21.*

Shettima, M. B. (2017). Impact of SMEs on employment generation in Nigeria. *IOSR Journal of Humanities and Social Sciences (IOSR-JHSS), 22(9), pp. 43-50.*

Sinha, D., & Sinha, T. (2007). Toda and Yamamoto Causality Test between per capita Savings and per capita GDP for India. MPRA Paper No. 2564.

Solow, R. (1957). Technical change and the aggregate production function. *The Review of Economics and Statistics, 39(3), pp. 312-320.*

Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics, 70(1), pp. 65-94.*

Teorell, J., Sundström, A., Sören, H., Bo, R., Pachon, N. A., Mert, D. C., Valverde, R. L., Phiri, V. S., & Gerber, L. (2025). The quality of government standard dataset, version Jan25. University of Gothenburg. The Quality of Government Institute. https://doi.org/10.18157/QoGStdJan25

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autogressions with possibly integrated processes. *Journal of Econometrica, 66 (1-2), pp. 225-250.*

UBEC (Universal Basic Education Commission) (2017). Education for all to the responsibility of all. https://ubeconline.com/about_ubec.php

Ukangwa, J. U., & Ikechi, V. I. (2022). The effect of exchange rate on economic growth of Nigeria. *Central Asian Journal of Innovations on Tourism Management and Finance, 3(7), pp. 10-22.*

UNESCO. (2010). World data on education. 7th ed. Nigeria: International Bureau of Education. UNESCO-IBE.

Utile, T. I., Ijirshar, V. U., & Sem, A. (2021). Impact of institutional quality on economic growth in Nigeria. *Gusau International Journal of Management and Social Sciences, 4(3), 157-177.*

Uwaifo, V. O., & Uddin, P. S. O. (2009). Transition from the 6-3-3-4 to the 9-3-4 system of education in Nigeria: An assessment of its implementation on technology subjects.

Studies on Home and Community Science, 3(2), 81-86. https://doi.org/10.1080/09737189.2009.11885280

Valeriani, E., & Peluso, S. (2011). The impact of institutional quality on economic growth and development: An empirical study. *Journal Knowledge Management, Economics and Information Technology, 1(6), 1-25.*

Wang, M., & Wong, S. M. C. (2011). Foreign direct investment, education, and economic growth: Quality matters. *Atlantic Economic Journal, 39*(2), pp. 103-115. https://doi.org/10.1007/s11293-011-9268-0

Wilfred, A. G., & Bokana, G. K. (2017). A comparative analysis of effects of education on sub-Saharan Africa's economic growth. *Journal of Economics and Behavioural Studies, 9(4), pp. 187-200.*

Woessmann, L. (2016). The economic case for education. Education Economics, Taylor & Francis Journals, 24(1), pp. 3-32. .http://www.tandfonline.com/doi/abs/10.1080/09645292.2015.1059801

Wolde-Rufael, Y. (2009). Energy consumption and economic growth: The experience of African countries revisited. *Energy Economics, 21, pp. 217-224.* https://doi.org/10.1016/j.eneco.2008.11.005.

Yamma, A. M., & Izom, D. Y. (2018). Education policy in Nigeria and the genesis of universal basic education (UBE), 1999-2018. *Global Journal of Political Science and Administration, 6(3), 15-32.*

Yusuf, S. A. (2014). The analysis of impact of investment in education on economic growth in Nigeria: Veracity of association of staff union of university of Nigeria's (ASUU) agitation. Munich Personal RePEc Archive, Paper No. 55524. http://www.mpra.ub.uni-muenchen.de/55524/

Zivot, E., & Andrews, D. W. K. (1992). Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis. *Journal of Business & Economic Statistics, 10(3), pp. 251-270.* https://doi.org/10.2307/1391541

CINEFORUM
ISSN: 0009-7039

Vol. 65. No. 4, 2025

Appendix 1: Detailed information on computation of CEIND using PCA

Principal components/correlation — Number of obs = 40; Number of comp. = 8; Trace = 8; Rotation: (unrotated = principal); Rho = 1.0000

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	3.5393	.872584	0.4424	0.4424
Comp2	2.66672	1.90708	0.3333	0.7758
Comp3	.759635	.195848	0.0950	0.8707
Comp4	.563787	.384809	0.0705	0.9412
Comp5	.178978	.0382277	0.0224	0.9636
Comp6	.14075	.0303175	0.0176	0.9811
Comp7	.110433	.0700352	0.0138	0.9950
Comp8	.0403977	.	0.0050	1.0000

Principal components (eigenvectors)

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7	Comp8
PSGER	-0.3091	-0.3185	0.6632	0.0011	0.5415	0.0757	-0.1349	-0.2143
SSGER	0.4546	-0.2028	0.0477	0.3612	0.3287	-0.5824	0.3707	0.1867
TSGER	0.4721	-0.1586	0.1019	0.3407	-0.1803	0.0254	-0.7639	-0.0938
ADLR	0.4939	-0.0508	0.2065	0.0725	0.0166	0.7418	0.3888	0.0618
SSYS	-0.3721	-0.3028	0.2886	0.4792	-0.6083	-0.0103	0.2020	0.2144
PSCR	0.2554	0.3444	0.6319	-0.4549	-0.3366	-0.2919	0.0247	0.1039
LSSCR	-0.0320	0.5641	0.1030	0.4596	-0.0249	-0.0459	0.1666	-0.6546
USSCR	-0.1619	0.5488	0.1078	0.3169	0.2863	0.1294	-0.2013	0.6491

Variable	Unexplained
PSGER	0
SSGER	0
TSGER	0
ADLR	0
SSYS	0
PSCR	0
LSSCR	0
USSCR	0

Principal component loadings (unrotated)
component normalization: sum of squares(column) = 1

	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7	Comp8
PSGER	-.3091	-.3185	.6632	.001098	.5415	.07575	-.1349	-.2143
SSGER	.4546	-.2028	.04775	.3612	.3287	-.5824	.3707	.1867
TSGER	.4721	-.1586	.1019	.3407	-.1803	.02538	-.7639	-.09381
ADLR	.4939	-.05082	.2065	.07254	.01663	.7418	.3888	.0618
SSYS	-.3721	-.3028	.2886	.4792	-.6083	-.01027	.202	.2144
PSCR	.2554	.3444	.6319	-.4549	-.3366	-.2919	.02466	.1039
LSSCR	-.03203	.5641	.103	.4596	-.02486	-.04588	.1666	-.6546
USSCR	-.1619	.5488	.1078	.3169	.2863	.1294	-.2013	.6491

Source: Researchers' computation using Stata software (version 14).