Assessing the Drivers of Steady State Economic Growth in Nigeria

ATOI, VICTOR NGOZI (PhD)

30 September 2023

Assessing the Drivers of Steady State Economic Growth in Nigeria

Atoi, Ngozi Victor

Central Bank of Nigeria

atoinv@gmail.com

Abstract

This study assesses the effects of foreign direct investment (FDI), government expenditures on education and health, trade openness, and initial income on steady state economic growth in Nigeria. The study utilised the Nonlinear Autoregressive Distributed Lag model with data obtained from the world bank development indicator database covering the period 2000Q1 to 2021Q4. The long run results showed evidence of asymmetric response of steady state economic growth to shocks emanating from FDI and health expenditure only. The impact of positive changes in FDI is greater than that of negative changes, while positive changes in health expenditure, although statistically insignificant, exert lesser influence than negative changes. Also, education expenditure is found to influence steady state economic growth positively. These findings are consistent with endogenous growth theory, which highlights the importance of technological innovation and human capital accumulation for sustainable growth. Furthermore, the estimated parameter of initial income is positive, indicating a possibility of convergence, however, trade openness has a marginal negative effect on steady state economic growth, reflecting the effect of unequal international trade competition. The study emphasized the need to intensify effort in attracting and retaining FDI, as well as re-evaluating trade policies to foster sustainable growth in Nigeria.

Key words: Steady state, asymmetry, endogenous growth

Jel Classification: O4, C5

1.0 Introduction

Steady State economic growth refers to a state of the economy where output growth and other economic variables remain at their long-run equilibrium levels. In a steady state, the economy is operating at its full potential, which implies the absence fluctuations in output, employment, or prices. The need for a steady-state economy cannot be overemphasized. It helps businesses and governments make long-term investments plan with greater certainty (Romer, 1986) and allows for the utilization of resources at a sustainable rate, which improves social welfare and reduces environmental degradation (Daly & Farley, 2011).

Nigeria is the largest economy in Africa, but the country's economic performance has been fluctuating over the years. The economy relies heavily on the oil and gas sector, making it vulnerable to global oil and gas market shocks. Between 2010 and 2015, the Nigerian economy experienced robust growth, but recorded negative growth in 2016 and 2020 due to international oil price shocks. When an economy experiences cycles of growth and contraction, it could widen the income gap between the rich and the poor (Zainal, et al, 2023) and could exacerbate environmental degradation, leading to a decline in ecosystem services and the loss of biodiversity (Dobson, 2006; Egoh et al., 2012). A firm understanding of the drivers/determinants of steady state economic growth in Nigeria could help retrack its economic performance on a sustainable path.

A number of studies have examined the role of education, investment, openness, health, and initial income in the determination of steady state growth and arrived at counterintuitive and conflicting results. For instance, it is expected that greater trade openness could enhance specialization, greater efficiency, and higher productivity, all of which should lead to steady state growth. However, Yu et al (2019) found a negative impact of trade openness on growth. Liang et al (2021) found a positive relationship between FDI and growth, but Abdouli and Hammami (2017) demonstrated a negative impact of FDI on growth.

According to Tchamyou et al (2019), lifelong learning has a positive impact on economic growth. Additionally, Marquez-Ramos and Mourelle (2019) found non-linearities in the relationship between education and economic growth, highlighting the significance of both secondary and tertiary education levels in promoting sustainable economic growth. However, economic growth responds negatively to investment and education of labour force (Marquez-Ramos & Mourelle 2019). Mohamed (2020) found that growth is negatively affected by life expectancy at birth, but Elwasila (2017a) found a positive relationship between health and economic growth in Sudan. The conflicting results prove that consensus on the drivers of steady state economic growth is still elusive.

The few existing studies conducted on Nigeria assumed symmetry in the determination of growth drivers (Ajide 2014, Malam et al. 2018, and Ojo & Ojo 2022), but nonlinearity may exist in the relationship between steady state growth and its driver. For instance, the effect of positive and negative changes in life expectancies on GDP per capita growth could vary with income levels because, at lower levels of income, longer life expectancies may have a greater positive impact on economic growth than at higher levels of income. Furthermore, FDI may have varying effects on steady state growth in different contexts. FDI has the potential to generate employment opportunities, stimulate technological spillovers, and promote sustainable economic growth. However, the impact of FDI may be heterogeneous and dependent on the level of economic development, investment type, and the host country's absorptive capacity (Asongu, & Odhiambo, 2020). Assuming linearity in the determination of steady state, where asymmetry exists may lead to unreliable parameter estimates and wrong policy outcomes.

This study aims at investigating the drivers of steady state economic growth in Nigeria. To achieve this objective, we test for asymmetry and apply the nonlinear autoregressive distributed lag (NARDL) model developed by Pesaran et al (2014) to estimate the long run drivers of steady state growth in Nigeria. The model is appealing to this study as it allows for the possibility of asymmetric: (i) effects of shocks on steady state (Nakhli, & Gaies, 2021), and (ii) adjustment of the drivers of steady state growth towards steady state itself (Amin et. al. 2022). These are some of the advantages that NARDL technique has over the symmetric ARDL, which make it generate more robust estimates for reliable policy prescriptions.

The significance of this study is manifold. It adds to the existing knowledge on the drivers of steady state economic growth in Nigeria, thereby aiding policymakers in formulating effective strategies to moderate fluctuations in economic growth and improve the standard of living in the country. Additionally, the findings could guide prioritization of resource allocation to critical sectors. Moreover, this study could serve as a valuable resource for academicians and researchers interested in understanding the factors driving steady state growth in developing economies.

The remainder of the study is structured as follows. Section two discusses the theoretical and related empirical literature, while section three focuses on the methodology applied in the study with emphasis on variables definition, some facts about the Nigeria economy, theoretical framework as well as model specification. Section four deals with result presentation and discussion, while section five concludes the study with policy recommendations.

2.0 Literature Review

2.1 Theoretical Literature Review

The Solow-Swan model (1956) model explains steady state in terms of the interaction between capital and labour, incorporating both exogenous (deterministic) and endogenous (stochastic) factors. The model provides the framework for analysing the long-term dynamics of economic growth, emphasizing the role of capital accumulation, and serves as a basis for subsequent research on endogenous growth theory. It has been widely tested empirically in both developed and developing countries, with studies finding mixed results. The model assumes an exogenous technological progress, diminishing returns to capital and labour, constant savings rates, and a closed economy. Despite its wide applicability, the model has been criticized for unrealistic assumptions, particularly the assumption of exogenous technological progress, and for neglecting the role of human capital and institutional factors in economic growth.

The Endogenous Growth Theory of Romer (1990) evolved from the Solow-Swan model (1956). It posits that technological progress is not exogenous, but rather is a result of human capital investment, innovation, and research and development. This theory is important to the study of steady state. It offers a more comprehensive view of economic growth by incorporating the role of knowledge and innovation. It has been applied empirically to explain differences in growth rates across countries and regions. It assumes knowledge spillovers, increasing returns to scale, and monopolistic competition, but it neglects the role of physical capital accumulation and ignoring the possibility of diminishing returns to knowledge.

The new growth theory, developed by Lucas (1990) also metamorphosed from the Solow-Swan model. This theory builds on the endogenous growth theory and suggests that innovation and knowledge accumulation can be spurred through competitive market forces and increasing returns to scale. Lucas argues that the accumulation of human capital and knowledge should be viewed as a form of investment that yields returns in the form of higher productivity and output (Lucas, 1990).

2.2 Empirical Literature Review

There is a wealth of empirical research examining asymmetry and nonlinearity in the relationship between economic growth and its drivers in developed, emerging, and developing economies, highlighting the role of education, health, investment, and degree of

trade openness. In these studies, some similarities are observed in terms of the methods used, such as panel data analysis, nonlinear autoregressive distributed lag (NARDL) models, symmetric ARDL, and ordinary least squares, etc.
In terms of how growth responds to health status, Jiang and Wang (2023) conducted a study in China using annual data from 1978 to 2021 to examine the relationship between human health capital and economic growth. The study found that private health expenditure has a significant positive effect, while government health expenditure has a significant negative effect on GDP per capita in the short- and long-term. Social service expenditure is found to have a positive effect on economic growth in both the short- and long-term. Similarly, Jahantabi and Golkhandan (2023) investigated the impact of public health expenditures on the health status during business cycles in Iran using time series data from 1979 to 2020. The study found that public health expenditures have a pro-cyclical behaviour and asymmetric impact, with negative shocks having a greater effect on weakening health indicators than positive shocks have on strengthening health indicators. The impact of shocks on public health expenditures during periods of economic recession is greater than that during periods of economic boom. In Nigeria, Bakare and Olubokun (2011) used the ordinary least square multiple regression to analyse the relationship between health care expenditure and economic growth in Nigeria. The study found that there is a positive and significant relationship between health care expenditures and economic growth in Nigeria. They recommended that policy makers in Nigeria should increase the yearly budgetary allocation to the health sector.

Human capital development as a driver of economic growth has been given attention by Mohamed (2022) who explored the role of female human capital in economic growth in Sudan. The study found a significant negative effect of female human capital on gross national income per capita, but significant positive effects of female labour participation and women's participation in the parliament on economic growth in both short- and long-term. The prevalence of HIV/AIDS among women has a significant negative effect on economic growth, reflecting the negative effect of female human capital. In a related study, Qi et. al. (2022) used an NARDL model to examine the impact of higher education progress and utilization, and their interaction with high-tech industries, on economic growth in China from 1980 to 2020. The study found that the expansion of higher education progress and high-tech industries stimulated economic growth, while contraction of these factors had negative effects. The study recommend that China should invest more in higher education and high-tech industries across all regions to enhance economic growth. In a similar fashion, Xia et al. (2022) utilized an NARDL model to evaluate the impact of secondary vocational education and training (SVET) and higher vocational education and training (HVET), as well as their association with high-tech industries, on China's economic growth from 1980 to 2020. The research conveyed that an upsurge in SVET and HVET positively contributed to economic growth, while a decrease in these factors resulted in negative effects. The study recommended that encouraging higher vocational education, promoting equitable development of high-tech industries, and cultivating high-quality talents in high-tech development and modern industrial innovation can lead to economic prosperity and transition.

A number of studies have also examined the role of investment in sustainable growth. For instance, Farouq et al (2020) investigated the interaction between economic growth and foreign direct investment (FDI) on the Nigerian financial sector using the NARDL model. They found a positive and significant effect of foreign direct investment on financial development and a unidirectional nonlinear causality between economic growth and financial development. Amin et al (2022) conducted a study on the impact of outward FDI (OFDI) on Romania's economic growth using the NARDL model. They found that both an increase and a decrease in OFDI have a positive and significant impact on economic growth, with a greater effect arising from the increase in OFDI. Similarly, Alam et al (2022) examined the asymmetric effects of foreign FDI on economic growth in India using the NARDL model. They found that positive shocks in FDI inflows have a positive impact on India's economic growth, while negative shocks have a negative impact, and financial development, inflation, and trade openness significantly affect economic growth.

In more recent studies on investment-growth nexus, Sohail and Li (2023) analysed the nonlinear relationship of economic growth, FDI, domestic investment, and financial development using the NARDL model for Pakistan. Their findings show that the positive effects of FDI and domestic investment dominate the negative effects. Rahman et al (2023) evaluated the impact of technological innovation, FDI, trade, and human capital on economic development in Bangladesh from 1990 to 2020 using the dynamic ARDL simulation method. The study found a long-run symmetric relationship between technological innovation, human capital, and economic development. Anda et al (2023) accessed the effect of FDI, trade, final consumption expenditures, exports, and imports of goods and services on the Romanian economic growth using the NARDL framework. The findings indicated that while trade and final consumption expenditures had a positive impact on Romania's economic growth, FDI and imports of goods and services had a detrimental effect.

Country’s exposure to international trade has also been given significant attention in the assessment of sustainable economic growth. Darku and Yeboah (2018) compared the openness-growth relationship between the high-performing Asian economies (HPAEs) and the rest of the developing world using the SYS-GMM estimator. The study highlights the importance of implementing policies that are complementary to economic openness in promoting economic growth in the developing world. Sriyana and Afandi (2020) investigated the effects of trade openness and other economic variables on economic growth in selected ASEAN countries. The results show that trade openness has a net positive impact on economic growth only in the Philippines and Singapore. Similarly, Udeagha and Ngepah (2021) utilized the trade openness proxy suggested by Squalli and Wilson (2011) in a nonlinear context to investigate the relationship between economic growth and trade openness in South Africa from 1960 to 2016. Their findings revealed asymmetrical short- and long-term impacts of trade openness on economic growth, underscoring significant policy implications. Recently, Suryandaru (2023) conducted a study on the relationship between public debt, trade openness, and economic growth in Indonesia using both symmetric and asymmetric models. The results indicate that trade openness has a significant effect on economic growth only in the asymmetric model, indicating that reducing trade openness can contribute to a rise in economic growth in the long run.

One study that attempt to consider all the development indicators discussed previously is Supattra and ÖZER (2018). They used a Bayesian model averaging approach to investigate the driving forces of economic growth in Southeast Asian countries. The study covered panel data for ten countries between 1975 and 2014 and found that FDI inflows are the main economic driver for the whole region. Population control, savings, and school enrolment are major drivers of economic growth in less developed countries. Furthermore, the study reveals that total factor productivity is a critical factor for overall economic growth in ASEAN founder countries, while the CLMV group (Cambodia, Laos, Myanmar, and Vietnam) shows an upward growth trend with population control, savings, and education as primary economic drivers. The study recommends that lower-middle-income countries focus on improving human capital through education and skill training, while upper-middle-income countries should invest more in research and development to become technological inventors rather than adopters.

Apart from these conventional development indicators of growth, other authors have considered variables such as natural resource, financial development, and inequality. The NARDL framework and nonlinear Granger causality were utilized by Ampofo et al (2020) to investigate the impact of total natural resource rent on the economic growth of the top ten mineral-rich countries covering the years 1981-2017. It was discovered that natural resource rent exhibited a positive effect on economic growth in Brazil and Canada, whereas it had an adverse effect on economic growth in Australia, DRC, and India. This finding confirmed the "resource curse" phenomenon in those countries. The study recommended more trade liberalization policies to enhance the benefits of trade openness, particularly in countries where the "natural resource curse phenomenon" has been reported. Similarly, Odugbesan et al (2021) investigated the impact of financial development and remittance on economic growth in MINT countries using panel data from 1980 to 2019. The study found that both financial development and remittance have a positive impact on economic growth. Positive or negative shocks in financial development and remittance led to an increase in economic growth in the long-term. The study recommends policies that encourage financial development and remittance inflows to promote economic growth in MINT nations.

Brueckner and Lederman (2018) conducted a panel study on the relationship between inequality and GDP per capita growth, taking into account countries' initial incomes. The study found that the relationship between inequality and GDP per capita growth is significantly decreasing in countries' initial incomes. In Low Income Countries, greater income inequality boosts transitional growth, while in High Income Countries, inequality has a significant negative effect on transitional growth. The study recommends policies that reduce inequality to promote long-term economic growth.

The studies reviewed can be compared to a puzzle, where each study examined different aspect of economic growth. The relationship between health capital and economic growth, studied by Jiang and Wang (2023), Jahantabi and Golkhandan (2023) and Bakare and Olubokun (2011), can be compared to the edges of the puzzle. Trade openness, represented by studies like Darku and Yeboah (2018), Sriyana and Afandi (2020), Udeagha and Ngepah

(2021), and Suryandaru (2023), is a fundamental piece in the puzzle of economic growth. Education and technological innovation, explored by Mohamed (2022), Qi *et. al.* (2022), and Xia et al (2022), are like connecting pieces in the puzzle. Finally, the impact of foreign direct investment on economic growth, as studied by Farouq et al (2020), Alam et al (2022), Alam et al (2022), Sohail and Li (2023), Rahman et al (2023), and Anda et al (2023), can be likened to the puzzle's central piece. When these puzzle pieces are put together, drivers of economic growth become clearer to understand. This unified picture can guide policymakers in formulating effective strategies to foster sustainable and inclusive economic growth. This integrated perspective is missing from the existing studies in Nigeria. Moreover, in our reviewed studies it is also evidenced that studies specific to Nigeria that assumed asymmetry are missing. The heterogeneity of findings justifies the need for this that consider non-linearities and asymmetries in the determination of steady state growth in Nigeria.

3.0 Methodology

3.1 Data and Variables

The study uses time series data obtained from the development indicators from World Bank database to examine the drivers of steady state in Nigeria from 2000Q1-2021Q4. The details of the variables are presented in Table 1. Although the data is available on annual basis, but converted to quarterly series using the frequency conversion technique in EViews 13.

Table 1: Variable and measurements

Variables	Acronym	Symmetric Link with GDP per capita	Measurements
Growth in GDP per capita	GDP		% of total population
Foreign direct investment	FDI	+ve/-ve	% of GDP
Government expenditure on education	EDX	+ve/-ve	% of total expenditure in public institutions
Government expenditure on health	HEX	+ve/-ve	% of general government expenditure
Trade openness	TRD	+ve/-ve	% of GDP
Initial Income	GDI	+ve/-ve	% growth

3.1.1 Link between steady state growth and its drivers

Several factors have been found to influence steady-state growth, including the ones considered in this study - education, FDI, trade openness, government health expenditures, life expectancy, and initial income. These variables are discussed, highlighting their link with economic growth.

Government expenditures on education and health can have significant impacts on steady-state growth, both positively and negatively. On the positive link, education is considered an essential driver of steady state economic growth as it can promote human capital formation, which can enhance workforce productivity. According to the Solow model, the level of technological progress depends on the stock of human capital, which is improved through investments in education (Mankiw et al., 1992). A more educated population is more likely to be productive and contribute to higher steady-state growth. Moreso, inefficient use of funds or inadequate monitoring and evaluation can lead to subpar education quality, which may undermine the potential positive impacts on growth. Equally, government spending on health can lead to better healthcare facilities, access to healthcare services, and improved public health outcomes. This, in turn, can lead to a healthier and more productive population, enhancing human capital. A healthier population is likely to be more productive, contributing to higher GDP per capita. However, Increased government expenditure on health may require higher taxes or borrowing, which can crowd out private investment or may lead to higher interest rates. This can adversely impact private sector investment and economic growth in the long run.

On the negative nexus, an increase in government expenditures on health and education could cause a decrease in GDP per capita due to potential burden on households and businesses through higher taxes or increased borrowing. This is capable of causing inefficiency, misallocation of resources, and an expansion of the public sector, limiting competition and innovation needed for sustainable growth. On the other hand, a decrease in government expenditures on health and education can potentially increase steady state growth. It can reduce the burden on households and businesses by not increasing tax or borrowing limit, leading to increased disposable income for private consumption and investment. Decreased spending can also promote efficiency, resource allocation, and private sector expansion, contributing to economic growth.

Foreign Direct Investment provides external financing for investment projects, facilitates technology transfer, and enhances the competitiveness of domestic firms (Borensztein et al., 1998). Increase in FDI can have both positive and negative effects on steady-state growth. In terms of positive relationship, foreign capital inflow is expected to increase the stock of capital and technical progress, which could generate higher growth. The outcome of the study by Koojaroenprasit, S. (2012) affirmed that FDI inflows have a positive impact on long term growth. On the negative side, there are circumstances where a decrease in FDI can lead to an increase in steady-state growth. This can occur when domestic firms shift their focus towards domestic investment, leading to improvements in productivity and economic efficiency. Similarly, by reducing reliance on FDI provides the opportunity for the host country to exercise greater policy autonomy, allowing them to pursue strategies that align with their specific development objectives.

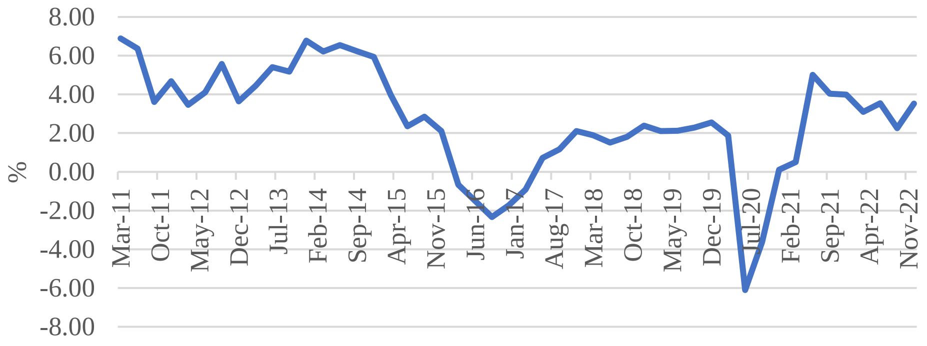
For trade openness, trade liberalization promotes productivity growth, enhances the transfer of technology, and facilitates the process of creative destruction by encouraging firms to adopt more efficient production techniques (Wacziarg & Welch, 2008). According to Rodrik, (1998), increased trade openness leads to higher steady-state growth rates. On the negative link, more international trade can increase competition from foreign firms, which may be harmful to domestic industries, leading to job loss, decreased investment, and slower economic growth. Moreover, greater reliance on imports can cause trade deficits, which weaken the domestic currency, increase national debt, and create economic imbalances. On the other hand, reduced trade openness can increase steady state growth because protection of domestic industries from foreign competition may help preserves jobs, encourages investment, innovation, and growth.

Initial income is an important factor in determining steady-state economic growth. According to the convergence hypothesis, Lower-income countries tend to grow faster to reach the steady state. Higher initial income can have positive effects on growth, allowing for increased capital accumulation and productivity enhancement. However, it can also have negative impacts due to factors like diminishing returns and resource dependence. Diminishing returns may occur when the marginal productivity of capital is low, leading to slower growth despite higher initial income. Moreover, economies reliant on a specific sector or limited resources may lack diversification and become vulnerable to external shocks. If the resource sector declines, the initial income can erode, thereby affecting steady-state growth negatively.

3.1.2 Stylized Facts on the Nigeria Economy

The economic condition of Nigeria, as reflected through the growth in real GDP, shows a mixed picture over the years (see Figure 1). The country has experienced periods of high and low growth rates. From March 2011 to September 2011, the real GDP growth rate was consistently above 3.5%, with a peak of 6.89% in March 2011. However, in the following quarters, the growth rate declined sharply, reaching a low of 2.11% in December 2015. The growth momentum of the economy moderated in 2015 compared with the level in 2014. According to CBN (2015), the growth in 2015 was driven, mainly, by the non-oil sector, which rose by 3.8 per cent.

Figure 1: Movements in Real GDP Gwoth Rate



The period from March 2016 to September 2017 was particularly challenging for the Nigerian economy, with negative growth rates for three consecutive quarters. Economic activities were significantly constrained by low crude oil production and price shocks, foreign exchange shortages and energy deficit. However, the economy showed signs of recovery in

December 2017, with a growth rate of 2.11%. The recovery was attributed to increased agricultural output arising from unconventional monetary policy implemented by the monetary authority.

After a brief period of slower growth from March 2018 to September 2018, the economy picked up again, reaching a growth rate of 2.38% in December 2018. Generally, the economy witnessed sustained growth in 2018, which the CBN (2018) attributed largely to fiscal stimulus due to rise in international price of crude oil, which led to increased infrastructural spending. The growth rate remained above 2% in the following year, 2019. However, with a negative growth rate of 6.10% in the second quarter of 2020, the economy experienced a significant contraction following the outbreak of the COVID-19 pandemic, and the collapse of crude oil prices in the world market thereby reversing the growth trajectory since 2017, when the economy exited recession. Notwithstanding, the economy rebounded strongly in the following quarters, with growth rates of 5.01% in June 2021 and 4.03% in September 2021.

Overall, the Nigeria economy as reflected in the growth in real GDP has been volatile. Although, the economy has shown signs of resilience and has recovered from periods of low growth in the past. The question that needs answer is whether the economy is in any way on the path of steady state.

3.2 Theoretical Framework

To assess the significance of the drivers of steady state growth, it is pertinent to establish the theoretical framework for estimating the empirical model. According to Solow model, a fast-growing economy is known to be far from its steady state. Hence, the growth in GDP per capital (GDP_t) can be expressed as:

$$GDP_t = \beta[y_t^s - GDI_t] \quad (1)$$

where β is a positive coefficient that determines how rapidly the economy converges to its steady state, y_t^s stands for steady state GDP, and GDI_t denotes initial income. Following the endogenous growth theory of Romer (1990), steady state growth is formulated as:

$$y_t^s = \omega + \alpha_1 FDI_t + \alpha_2 EDX_t + \alpha_3 HEX_t + \alpha_4 TOP_t \quad (2)$$

where α_1, α_2, α_3 and α_4 are coefficients that reflect the impact of investment, education, health, and trade openness, respectively.

Combining the two frameworks by substituting equation 2 into equation (1), we re-express stead state growth as:

$$Y_t = \theta + \beta\alpha_1 FDI_t + \beta\alpha_2 EDX_t + \beta\alpha_3 HEX_t + \beta\alpha_4 TOP_t - \beta GDI_t + \varepsilon_t \quad (3)$$

As in Miles, Scott and Breedon (2013), we re-formalize equation (2)

$$Y_t = \theta + \vartheta_1 Edu_t + \vartheta_2 Inv_t + \vartheta_3 HEX_t + \vartheta_4 TOP_t - \beta GDI_t + \varepsilon_t \quad (4)$$

Equation 4 is a typical endogenous growth theory formation considered in this study.

3.2.1 Model Specification

This study adapts the NARDL model technique developed by Pesaran et al (2014) for the benefits it offers. The NARDL model is an extension of the standard ARDL model of Pesaran et al (2001) that allows for the examination of nonlinearity and asymmetry in the relationship among variables. This means that it captures the varying adjustments of dependent variable to positive and negative changes in the independent variable in the short and long run. The model captures, more accurately, the changes in the relationship between variables, and handles outliers and missing data in time series more efficiently (Jiang et al., 2022). The NARDL model produces robust estimates even with small sample, and it is amenable to stationary and first difference series (Pesaran et al, 2001).

The symmetric ARDL is a starting point for NARDL estimation. Therefore, in line with Pesaran, Shin, and Smith (1997, 2001), the standard ARDL model is given as:

$$\Delta y_t = \alpha + \sum_{j=1}^{p-1} \beta_j \Delta y_{t-j} + \sum_{j=0}^{q} \lambda_j \Delta x_{t-j} + \rho y_{t-1} + \theta x_{t-1} + \varepsilon_t \quad (5)$$

where Δ is the first difference operator, α is the drift component, β and λ are short-run dynamics, ρ and θ represent long-run dynamics, and j is the lag component.

Given that the $EC_t = \rho y_{t-1} + \theta x_{t-1} + \tau_t$, the error correction ($EC$) form of equation 5 is presented as:

$$\Delta y_t = \alpha + \sum_{j=1}^{p-1} \beta_j \Delta y_{t-j} + \sum_{j=0}^{q} \lambda_j \Delta x_{t-j} + \delta EC_{t-1} + \upsilon_t \quad (6)$$

where δ is the speed of adjustment parameter and EC represents the residuals obtained from estimated ARDL model in equation 5. While ARDL is a natural starting point for NARDL estimation, it does not match the behavioral finance and economics literature approach for modelling nonlinearity and asymmetry.

Thus, Pesaran et al (2014) decomposed the variations in the independent variables (x_t) in equation 5 into partial sum of positive (${x^+}_t$) and negative (${x^-}_t$) changes, such that:

$${x^+}_t = \sum_{j=i}^{t} {\Delta x^+}_j = \sum_{j=0}^{t} \max\left(\Delta x_j, 0\right) \quad (7)$$

$${x^-}_t = \sum_{j=i}^{t} {\Delta x^-}_j = \sum_{j=0}^{t} \min\left(\Delta x_j, 0\right) \quad (8)$$

The decomposition enables the estimation of asymmetric cointegration by assuming that the response of the dependent variable y_t, to positive and negative changes in the independent variable is asymmetric. Based on equations (7) and (8), the NARDL model of equation 5 is modified as:

$$\Delta y_t = \alpha + \sum_{j=1}^{p-1} \beta_j \Delta y_{t-j} + \sum_{j=0}^{q} {\lambda^+}_j \, {\Delta x^+}_{t-j} + \sum_{j=0}^{q} {\lambda^-}_j \, {\Delta x^-}_{t-j} + \rho_i y_{t-1} + \theta^+ {x^+}_{t-1} + \theta^- {x^-}_{t-1} + \omega_t \quad (9)$$

where ω_t is residuals of NARDL model, assumed to be normally distributed with zero mean and homoscedastic.

Like equation 6, the error correction form of equation 9 is expressed as:

$$y_t = \alpha + \sum_{j=1}^{p-1} \beta_j \Delta y_{t-j} + \sum_{j=0}^{q} \lambda^{+}{}_j \, \Delta x^{+}{}_{t-j} \; + \sum_{j=0}^{q} \lambda^{-}{}_j \, \Delta x^{-}{}_{t-j} \; + \pi EC_{it-1} + \zeta_t \qquad (10)$$

where π is the long run adjustment parameter. Considering our hypothesized drivers of steady state and assuming that the effect of initial income is symmetric based on convergence conditions, the long run and short run of equation 4 expressed with NARDL model is given as:

$$\begin{aligned}\Delta GDP_t = \alpha &+ \sum_{j=1}^{p-1} \beta_j \Delta GDP_{t-j} + \sum_{j=0}^{q} \lambda^{+}{}_{1j} \, \Delta FDI^{+}{}_{t-j} \; + \sum_{j=0}^{q} \lambda^{-}{}_{2j} \, \Delta FDI^{-}{}_{t-j} \\ &+ \sum_{j=0}^{q} \lambda^{+}{}_{3j} \, \Delta EDX^{+}{}_{t-j} \; + \sum_{j=0}^{q} \lambda^{-}{}_{4j} \, \Delta EDX^{-}{}_{t-j} \; + \sum_{j=0}^{q} \lambda^{+}{}_{5j} \, \Delta HEX^{+}{}_{t-j} \\ &+ \sum_{j=0}^{q} \lambda^{-}{}_{6j} \, \Delta HEX^{-}{}_{t-j} \; + \sum_{j=0}^{q} \lambda^{+}{}_{7j} \, \Delta TRD^{+}{}_{t-j} \; + \sum_{j=0}^{q} \lambda^{-}{}_{8j} \, \Delta TRD^{-}{}_{t-j} \\ &+ \sum_{j=0}^{q} \lambda^{-}{}_{9j} \, \Delta GDI_{t-j} \; + \; \rho GDP_{t-1} + \theta^{+}{}_1 FDI^{+}{}_{t-1} + \theta^{-}{}_2 FDI^{-}{}_{t-1} \\ &+ \theta^{+}{}_3 EDX^{+}{}_{t-1} + \theta^{-}{}_4 EDX^{-}{}_{t-1} + \theta^{+}{}_5 HEX^{+}{}_{t-1} + \theta^{-}{}_6 HEX^{-}{}_{t-1} \\ &+ \theta^{+}{}_7 TOP^{+}{}_{t-1} + \theta^{-}{}_8 TRD^{-}{}_{t-1} - \theta_9 GDI_{t-j} \\ &+ \omega_t \end{aligned} \qquad (11)$$

In line with Miles, Scott and Breedon (2013), equation 11 is estimated to answer the following questions.

- Is there evidence that the economy is converging to its steady state? Convergence is established if the long run effect of GDI is positive (that is $\theta_9 > 0$) in equation 11.
- Do positive and negative changes in the hypothesized drivers influence steady state growth in the long run? The coefficients ($\theta_i^{+}$and θ_i^{+}) that are statistically significant are said to affect the steady state growth in the long run.
- What impact does positive and negative changes in the hypothesized drivers have on the steady state in the long run? The magnitude and direction of the coefficients ($\theta_i^{+}$and θ_i^{-}) determine the long run impact of the variables on GDP.

We test for asymmetric cointegration to determines if there is a threshold effect in the long-run relationship among the variables, whether the adjustment towards equilibrium could be faster in one direction than the other.

In line with Schorderet (2003), we specify a stationary linear combination of the partial sum in the long run as:

$$z_t = \rho GDP_{t-1} + \theta^+{}_1 FDI^+{}_{t-1} + \theta^-{}_2 FDI^-{}_{t-1} + \theta^+{}_3 EDX^+{}_{t-1} + \theta^-{}_4 EDX^-{}_{t-1} + \theta^+{}_5 HEX^+{}_{t-1} + \theta^-{}_6 HEX^-{}_{t-1} + \theta^+{}_7 TRD^+{}_{t-1} + \theta^-{}_8 TRD^-{}_{t-1} + \theta_9 GDI_{t-j} + \gamma_t \quad (12)$$

To determine the asymmetric cointegration, in line with Shin et al (2014), we test the null hypothesis:

$$H0: \quad \rho = \theta^+{}_1 = \theta^-{}_2 = \theta^+{}_3 = \theta^-{}_4 = \theta^+{}_5 = \theta^-{}_6 = \theta^+{}_7 = \theta^-{}_8 = \theta_9 = 0$$

Based on F-Distribution, asymmetric cointegration is confirmed if H0 is rejected by conducting a bound test on equation 11. Pesaran et al (2001) provided critical values at different significance levels for upper bound and lower bound. If the test statistics (F-Distribution) falls: (i) above the upper bound, H0 is rejected, (ii) below the upper bound, H0 cannot be rejected, and (iii) within the upper and lower bounds, the test is considered inconclusive. The cointegration is supported with the estimation of error correction (EC) form of equation 11, specified as:

$$\begin{aligned} \Delta GDP_t = \alpha &+ \sum_{j=1}^{p-1} \beta_j \Delta GDP_{t-j} + \sum_{j=0}^{q} \lambda^+{}_{1j}\, \Delta FDI^+{}_{t-j} + \sum_{j=0}^{q} \lambda^-{}_{2j}\, \Delta FDI^-{}_{t-j} \\ &+ \sum_{j=0}^{q} \lambda^+{}_{3j}\, \Delta EDX^+{}_{t-j} + \sum_{j=0}^{q} \lambda^-{}_{4j}\, \Delta EDX^-{}_{t-j} + \sum_{j=0}^{q} \lambda^+{}_{5j}\, \Delta HEX^+{}_{t-j} \\ &+ \sum_{j=0}^{q} \lambda^-{}_{6j}\, \Delta HEX^-{}_{t-j} + \sum_{j=0}^{q} \lambda^+{}_{7j}\, \Delta TRD^+{}_{t-j} + \sum_{j=0}^{q} \lambda^-{}_{8j}\, \Delta TOP^-{}_{t-j} \\ &+ \sum_{j=0}^{q} \lambda^-{}_{9j}\, \Delta GDI_{t-j} + \emptyset EC_{t-1} + \omega_t \qquad (13) \end{aligned}$$

where $\emptyset$ is the speed of adjustment parameter and *EC* is the residuals obtained from long run component of equation 11. The estimated adjustment parameter ($\emptyset$) must be negative, less than 1 in absolute term and statistically significant for *EC* to adjust the model to its long run equilibrium when it drifts apart in the short run.

Using Wald Test, we also test whether the response of the growth in GDP per capita to positive and negative changes in the hypothesized steady state drivers is truly asymmetric. From equation 11, the null hypotheses for the long run and short run asymmetric effects, therefore, are:

$$\text{H0:} \quad \frac{\theta^+{}_1}{\rho} = \frac{\theta^-{}_2}{\rho} = \frac{\theta^+{}_3}{\rho} = \frac{\theta^-{}_4}{\rho} = \frac{\theta^+{}_5}{\rho} = \frac{\theta^-{}_6}{\rho} = \frac{\theta^+{}_7}{\rho} = \frac{\theta^-{}_8}{\rho}$$

$$\text{H0:} \quad \lambda^+{}_1 = \lambda^-{}_2 = \lambda^+{}_3 = \lambda^-{}_4 = \lambda^+{}_5 = \lambda^-{}_6 = \lambda^+{}_7 = \lambda^-{}_8$$

From the Wald test of the estimated parsimonious NARDL model, we reject H0 if the p-value is less than 0.05 level and conclude that the relationship is truly asymmetric.

To substantiate the significance of long run and short run asymmetric effects, we evaluate the asymmetric cumulative dynamic multiplier. In line with Pesaran et al (2014), the dynamic multiplier for positive and negative changes in the steady state driversts is accessed by the first order partial derivatives of the response variable, growth in GDP per capita, with respect to positive and negative changes in the drivers:

$$\sum_{k=0}^{h} \frac{\partial y_{t+k}}{\partial x^{+}{}_{it}} \text{ and } \sum_{k=0}^{h} \frac{\partial y_{t+k}}{\partial x^{-}{}_{it}}$$

If $h \to \infty$, then:

$$\sum_{k=0}^{h} \frac{\partial y_{t+k}}{\partial x^{+}{}_{it}} \to \frac{-\theta^{+}{}_{i}}{\rho_i}\text{; and}$$

$$\sum_{k=0}^{h} \frac{\partial y_{t+k}}{\partial x^{-}{}_{it}} \to \frac{-\theta^{-}{}_{i}}{\rho_i}$$

Asymmetric cumulative dynamic multiplier shows the pattern of adjustments of the dependent variable to its new long new run equilibrium due to positive or negative shocks in the independent variables. In this study, our emphasis is on long run asymmetric determinants of steady state in Nigeria given that steady state pertains to long run growth.

4.0 Results and Discussion

4.1 Descriptive Statistics

The descriptive statistics of the transformed data on the six variables considered in this study is reported in table 2. The average and variability of the growth rate of real GDP per capita are represented by a mean and standard deviation of 0.106625 and 0.033621, respectively; the positive mean indicates a generally positive trend, while the relatively low standard deviation suggests moderate fluctuations.

Table 2: Descriptive Statistics of Variables

	GDP	FDI	EDX	HEX	TRD	GDI
Mean	0.106625	0.007875	1.890716	0.008966	8.968091	0.011091
Std. Dev.	0.033621	0.138947	0.332268	0.001479	2.586780	0.019449
Skewness	-0.344860	1.410692	-0.462588	0.883173	-0.177933	0.072975
Kurtosis	1.644543	7.857539	1.919880	4.093634	2.191190	2.418867
Observations	88	88	88	88	88	88

For foreign direct investment (FDI), the mean and standard deviation are 0.007875 and 0.138947, respectively, indicating relatively low levels of investment with moderate variability. A positively skewed distribution (skewness of 1.410692) and a higher peak with longer tails (kurtosis of 7.857539) suggest a leptokurtic distribution. The government expenditure on education (EDX) has an average of 1.890716 and a standard deviation of 0.332268, indicating reasonable attention to the education sector with moderate variability. A negatively skewed distribution (skewness of -0.462588) and normal peak and tails (kurtosis of 1.919880) suggest a mesokurtic distribution.

With a mean of 0.008966, the government expenditure on health (HEX) suggests a relatively low life expectancy, with low variability (standard deviation of 0.001479). The positively skewed distribution (skewness of 0.883173) and higher peak with longer tails (kurtosis of 4.093634) suggest a leptokurtic distribution. For trade openness (TRD), a mean of 8.968091 represents a high level of trade with a relatively high variability (standard deviation of 2.586780). A roughly symmetrical distribution (skewness of -0.177933) and normal peak and tails (kurtosis of 2.191190) suggest a mesokurtic distribution. Finally, the mean of gross domestic income (GDI) is 0.011091, indicating a relatively high-income level with low variability (standard deviation of 0.019449). The roughly symmetrical distribution (skewness of 0.072975) and normal peak and tails (kurtosis of 2.418867) suggest a mesokurtic distribution.

4.2 Unit Root

The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are used to determine if a series is stationary or non-stationary. The ADF test assumes independently and identically distributed errors, while the PP test allows for autocorrelated errors. Conducting both tests provide a more robust analysis as autocorrelation can affect the results of one test. The ADF and PP unit root test results are presented in table 3.

Table 3: Unit Root Test Results

Augmented Dickey-Fuller Unit Root Test Result

	@ levels		@ First Difference	
Variable	t-Statistics	Prob-Value	t-Statistics	Prob-Value
GDP	-1.5576	0.4998	-3.4364	0.0123
FDI	-3.3610	0.0154	-6.1882	0.0000
EDX	-1.6136	0.4709	-2.6855	0.0811
HEX	-2.5293	0.1125	-2.4538	0.0146
TRD	-1.8296	0.3638	-6.3281	0.0000

Phillips-Perron Unit Root Test Result

	@ level		@ First Difference	
Variable	Adj. t-Stat	Prob-Value	t-Statistics	Prob-Value
GDP	-1.7350	0.4103	-3.5095	0.0100
FDI	-3.6331	0.0069	-5.8676	0.0000
EDX	-1.2104	0.6670	-4.9009	0.0001
HEX	-2.5054	0.1177	-5.6032	0.0000
TRD	-2.1158	0.2391	-4.9126	0.0001

The results show that all the variables are non-stationary and possess first-order integration (I(1)), except for FDI, which is stationary (integrated at level). This provides justification for NARDL model, which is suitable for estimating the combination of I(0) and I(1) series.

4.3 Coefficient Asymmetry Test

To determine if the effects of positive and negative changes in the of steady-state drivers differ in the long run and short run, a coefficient symmetry test is conducted. It uses the Wald test statistic to test the null hypothesis of symmetry of long-run and short-run coefficients of the estimated NARDL model specified in equation 11. The estimated NARDL model is presented in Appendix 1, while the Wald test result is shown in table 4.

Table 4: Wald Test of Symmetric Coefficient

Variable	Statistic	Value	Probability
Long-run			
EDX	F-statistic	1.169027	0.2854
	Chi-square	1.169027	0.2796
FDI	*F-statistic*	*38.61266*	*0.0000*
	Chi-square	*38.61266*	*0.0000*
HEX	*F-statistic*	*12.92258*	*0.0008*
	Chi-square	*12.92258*	*0.0003*
TRD	F-statistic	0.733391	0.3963
	Chi-square	0.733391	0.3918
Short-run			
EDX	F-statistic	0.061761	0.8049
	Chi-square	0.061761	0.8037
FDI	*F-statistic*	*7.389658*	*0.0093*
	Chi-square	*7.389658*	*0.0066*
HEX	*F-statistic*	*10.33642*	*0.0024*
	Chi-square	*10.33642*	*0.0013*
TRD	F-statistic	0.191691	0.6636
	Chi-square	0.191691	0.6615
Joint (Long-Run and Short-Run)			
EDX	F-statistic	0.746254	0.4799
	Chi-square	1.492508	0.4741
FDI	***F-statistic***	***21.33475***	***0.0000***
	Chi-square	***42.66949***	***0.0000***
HEX	***F-statistic***	***18.27718***	***0.0000***
	Chi-square	***36.55435***	***0.0000***
TRD	F-statistic	0.420037	0.6596
	Chi-square	0.840073	0.6570

The probability values associated with the F-statistic and Chi-square indicate that there is sufficient evidence to infer that the effect of positive and negative changes in foreign direct investment (FDI) and health expenditure (HEX), vary in the short run and long run. Nonetheless, the null hypothesis of coefficient symmetric effect of education expenditure (EDX) and trade openness (TRD) cannot be rejected.

Based on the Wald test, accounting for asymmetry in EDX and TRD when it does not exist could lead to erroneous conclusions, while considering asymmetry in the appropriate variables would yield a more accurate parameter estimates. Hence, the NARDL model is re-estimated by accounting for asymmetric effect of FDI and HEX only, while maintaining the symmetric behaviour of EDX, TRD and GDI. The re-estimated model and the corresponding error correction form are presented in Appendices 2 and 3. However, only the long-run results (levels equation) are reported in table 5 since emphasis is on the long run drivers of steady state economic growth in Nigeria.

4.4 Long Run Results of Steady State Drivers

Table 5 reports the estimated long run NARDL model for the steady state growth drivers in Nigeria. Estimated long run parameters in Appendix 2 are used to derive the coefficients of level form equation. The results indicate that FDI+, which represents positive changes in FDI (positive FDI shock), EDX, and GDI have positive effects on the growth of real GDP per capita. In contrast, FDI-, which represents negative changes in FDI (negative FDI shock), HEX+, and HEX-, which represents positive and negative changes in health expenditure (positive and negative HEX shocks), and TRD are found to have negative effects on steady state economic growth. All variables, except for positive changes in health expenditures, have statistically significant coefficients.

Table 5: Levels Equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI+	0.0159	0.0023	6.9757	0.0000
FDI-	-0.0119	0.0026	-4.6580	0.0000
EDX	0.0086	0.0013	6.4551	0.0000
HEX+	-0.4265	0.3322	-1.2839	0.2049
HEX-	-5.0962	0.5413	-9.4156	0.0000
TRD	-0.0007	0.0002	-4.4697	0.0000
GDI	0.1992	0.0219	9.1075	0.0000
C	0.0443	0.0043	10.3640	0.0000
EC(-1)	*-0.1841*	*0.0176*	*-10.4852*	*0.0000*
Adj. R-sq	0.8889		S.D. dep. Var.	0.0009
D-Wstat	1.6482		Schwarz cri	-12.3872

At 1% significance level, a unit change in FDI+ and EDX an increase in steady state growth by about 0.02 and 0.01, respectively. In line with endogenous growth theory, the positive long-run effect of FDI and EDX suggests their contributions to the accumulation of human capital and technological innovation, which are crucial for sustainable economic growth. Foreign capital inflows may have contributed to increase the stock of capital and technical progress that led to higher long-term growth. These findings corroborate the results of some previous studies, such as Choong et al. (2005) and Akinlo (2004), which also found a positive relationship between FDI and economic growth in Malaysia and Nigeria, respectively. Additionally, empirical evidence from Islam & Alam (2022) and Ozturk (2008) supports the positive effect of education expenditures on economic growth in the long run.

However, a unit decrease in FDI (FDI-) leads to about 0.01 decline in steady state growth, indicating that capital flight may harm the domestic economy by reducing investment and weakening the balance of payments position. Likewise, a unit increase in HEX- at 1% significance level results in a decline in steady state growth by about 5.10 units. This suggests that a negative shock in health expenditure may lead to a decrease in life expectancy, which may have long-term implications for economic growth (Sethi, Mohanty, Das, & Sahoo 2020).

The estimated coefficient of initial income (GDI), is positive and statistically significant at the 1% level, indicating a possibility of convergence of the Nigerian economy to a steady state. The result suggests that with more resources available, the country can create an environment conducive for technological innovation. The adoption and diffusion of new technologies can boost productivity and efficiency, leading to a more stable GDP per capita growth in the long run. The positive effects highlight the potential benefits of higher initial income, nonetheless, the coefficient (0.1992) is marginal for convergence compared with other economies that have a coefficient of 2.

While the coefficient of HEX+ is negative, it is not statistically significant. This result counterintuitive and contradicts previous studies that found a positive relationship between health expenditures and economic growth. Raghupathi, and Raghupath (2020) found that health expenditure can improve labour productivity, while Atilgan, Kilic, & Ertugrul (2017) found that improved health can lead to increased economic growth. Possible explanations for the negative effect of positive shock in health expenditure may include the complex relationship between health expenditures and economic growth. This relationship which may depend on other factors such as the quality of healthcare delivery and the types of health services being provided, or differences in the operationalization and measurement of health expenditures.

Finally, the result also shows that TRD has negative coefficient that is statistically significant, indicating that a decrease in trade openness results in a marginal decline in GDP per capita. Again, this result is counterintuitive as an increase in trade openness is expected to engender positive economic growth. The negative relationship may not be unconnected to unequal competition in international trade and its adverse effects on domestic industries. Opening up trade, through trade liberalization can expose domestic industries to harmful competition from foreign firms, where domestic firms may not have the capacity to compete effectively with foreign counterparts thereby weakening their contribution to growth. This highlights the need for well-designed trade policies that promote a balanced approach by ensuring that domestic firms in Nigeria have the opportunity to compete, adapt, and diversify, while also benefitting from the advantages of international trade in order to promote long term growth. This result is consistent with the findings of Hye and Lau (2015), who found a negative impact of trade openness on economic growth but contradicts Kumari et al (2023).

The coefficient of one period lag of the error correction term (ECM) is negative, less than one (-0.1841), and statistically significant at the 1% level. This indicates that the estimated adjustment parameter has the capacity to return the model to its equilibrium when the short run variables drift apart. However, the speed of adjustment is relatively small, as only about 18% of the drift is corrected within a quarter, that is, more than two-third of the drift would be corrected in one year. The estimated error correction model is reported in Appendix 3.

The model adequacy metrics show that the model has a high adjusted R-squared value of 0.89, indicating that the independent variables explained a large percentage of the variations in steady state growth. The Durbin-Watson statistic (1.65) indicates that there is no significant autocorrelation in the residuals, while the Schwarz criterion (-12.39) suggests that the model has a good fit and parsimony.

4.5 Cointegration - NARDL Bound Test

The bound test is used to establish the existence of asymmetric long-run effects of positive and negative shocks on the steady state economic growth. The F-stat value is reported in table 6, along with its significance level for different confidence intervals and for I(0) and I(1).

Table 6: ***Cointegration - NARDL Bound test***

F-stat Value	Signif. Level	I(0)	I(1)
	10%	2.017	3.052
13.648	5%	2.336	3.458
	1%	3.021	4.35

The F-stat value (13.648) is higher than the upper values of the bound test [I(1)] at all conventional significance levels, which shows that the null hypothesis of no asymmetric long-run effects is rejected at the 1% significance level for I(1) variables.

The mean reverting nature of the cointegrating graph in figure 2 further validates the bound test result in table 6. The mean-reverting cointegrating series suggests that the variables in the model have a long-run relationship such that any deviation from this relationship will eventually be corrected and return to the long-run equilibrium. This is a desirable characteristic as it indicates that the model is stable and can be used for policy decision.

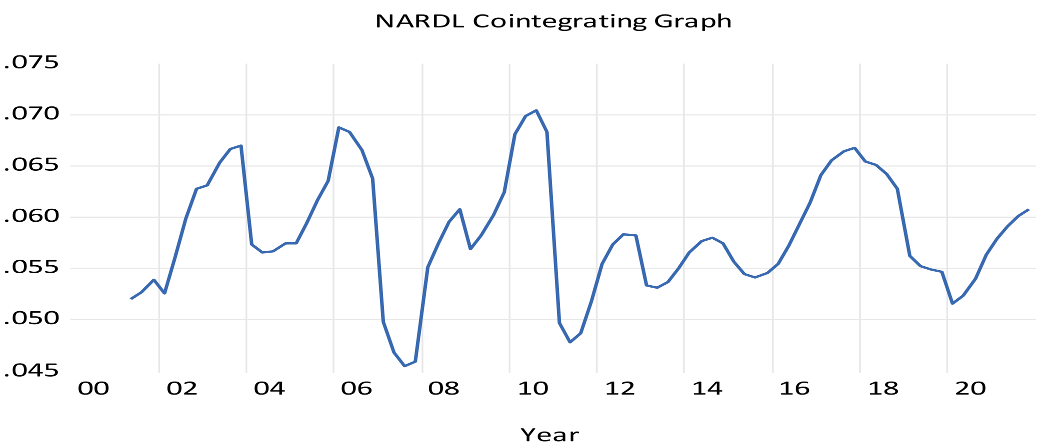


Figure 2 : Cointegrating Graph

4.6 Cumulative dynamic multiplier graph

The presence of asymmetry in the relationship between GDP and FDI is validated by the cumulative dynamic multiplier graph in figure 3, which shows how steady state economic growth (GDP per capital growth) transcends over short and long run due to positive and negative shock to FDI. The asymmetry (red line) never crosses the zero line in all horizon, thus, validating statistical significance of asymmetric effect of FDI reported in the Wald test result reported in table 4.

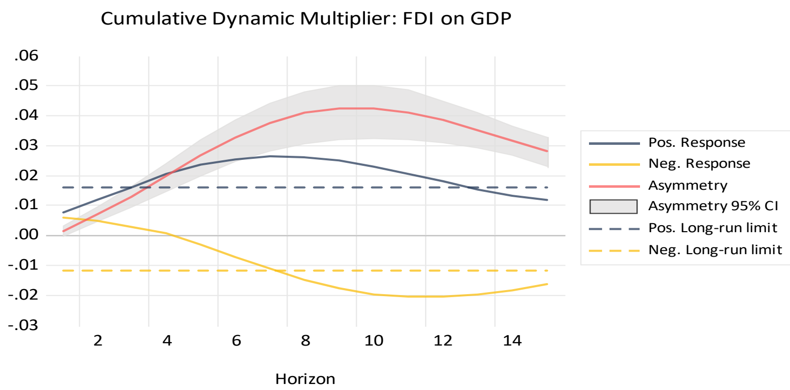


Figure 3: Cumulative dynamic multiplier graph of GDP response to FDI

Positive and negative shock to FDI have positive impact on steady state GDP growth in the short run, as presented in figure 3, and this finding is consistent with the estimated NARDL model presented in Appendix 2. However, the response of steady state economic growth to negative and positive shocks in FDI varies in the long run, responding negatively to negative shock (FDI-) and positively to positive shock (FDI+). The effect of positive shock to FDI appears to be more pronounced, but marginal. This result is also consistent with the long run estimated result presented in table 5.

In figure 4, the response of steady state growth to positive and negative shocks in HEX is presented. The presence of asymmetry in GDP and HEX relationship is validated as the asymmetry (red line) never crosses the zero line. This corroborate the Wald test result in table 4.

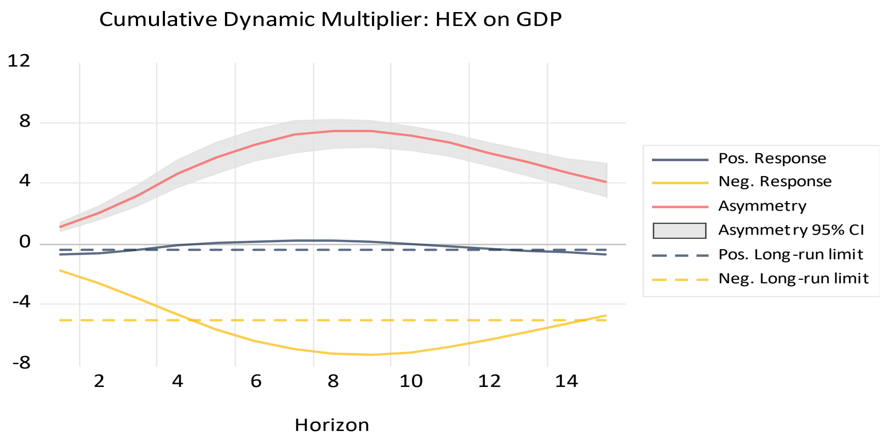


Figure 4: Cumulative dynamic multiplier graph of GDP response to HEX

The effect of positive shock to health expenditure (HEX+) in the short and long run is negative, while negative shock in health expenditure (HEX-) has a negative impact on steady state growth. The effect of positive shock in in health expenditure is less persistent but statistically insignificant, as reflected in the positive response of steady state growth to positive shock in in health expenditure crossing of the zero line. This result is consistent with the estimated long run NARDL model result presented in table 5 and Appendix 2.

4.7 Model Diagnostics

The diagnostic tests are performed to assess the model's goodness of fit and the validity of its assumptions. The diagnostic results are presented in table 7. The absence of serial correlation in the residual indicates that the errors are independently distributed, while homoscedasticity of the residual suggest that the variance of the errors is constant across the range of the independent variable. At 1% significance level, the results reveal no evidence of serial correlation and heteroskedasticity in the residuals as the F-stat and their respective probability values are significantly high. These tests are important because serial correlation and heteroscedasticity can lead to biased and inconsistent estimates of the regression coefficients, and can also affect the accuracy of the statistical inference.

Table 7: ***Diagnostics***

	F-stat	P-Value
Serial Correlation	1.8688	0.1649
Homoskedasticity	0.8998	0.6152

Autocorrelation (AC) of the model residual

	AC	Partial AC	Q-Stat	P-Value
Lag1	-0.033	-0.033	0.0911	0.7630
Lag5	0.046	0.050	0.7197	0.9820
lag10	-0.082	-0.090	2.0051	0.9960
lag15	-0.051	-0.039	4.3665	0.9960

Autocorrelation (AC) shows the correlation among the residuals at different time lags, while partial autocorrelation (PAC) is the correlation between residuals after controlling for the effects of previous lags. The AC and PAC test results show no evidence of autocorrelation in the residuals for up to 15 lags as the P-values at different lags are higher than 5% level. Thus, this emphasizes the goodness of fit of the estimated model. Supporting the AC test with the PAC is necessary because the PAC helps to identify important and shifted lags that may impact the model, which may be missed by AC analysis alone. Given the robustness of the diagnostic metrics, the estimated asymmetric NARDL model is a good fit for the data and provides valuable insights into the long run drivers of steady state economic growth in Nigeria. m

Model Stability

A cumulative sum (CUSUM) and a cumulative sum of squares (CUSUMSQ) residuals in figures 5 and 6, respectively, are used to monitor the goodness-of-fit of the estimated NARDL model over time. If the CUSUM and CUSUMSQ values fall within the upper and lower limits, we can be confident at 95% level that any changes or trends in the residuals are not statistically significant. In this case, the CUSUM and CUSUMSQ of residuals are within the limits from 2017 to 2021, which indicate that the model's fit is statistically stable and shows no signs of instability or structural breaks over the observed period.

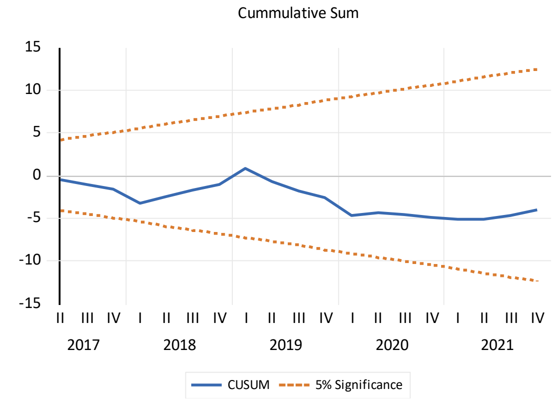


Figure 5: Cumulative Sum

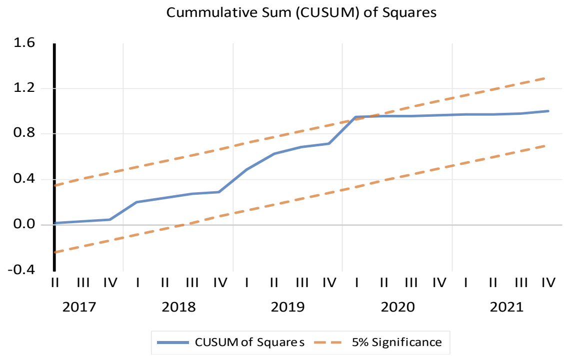


Figure 6: Cumulative Sum of Squares

The CUSUMSQ touched the upper limit in 2020Q1, but since the CUSUM and CUSUMSQ values did not cross the control limits, we conclude that the model's fit remains stable overall and can be used for policy prescriptions.

5.0 Conclusion and Recommendations

5.1 Conclusion

Enthused by the implications of long-term growth, this study examines the drivers of steady state economic growth in Nigeria by testing for asymmetric long run effects of foreign direct investment, government expenditure on education and health, trade openness, and initial income on growth rate of real GDP per capita. The study employed the NARDL model using a quarterly time series data from 2000 to 2021 obtained from the World bank development indicators database. While symmetric effect of initial income on long term growth is assumed based on convergence condition, the study revealed asymmetric responses of steady state economic growth to foreign direct investment, and health expenditure only but found strong evidence for not rejecting the null hypothesis of symmetric effects of education expenditure, and trade openness. This necessitated the need to account for asymmetric response of steady state economic growth to FDI and health expenditure in order to gain deeper understanding of the factors influencing Nigeria's economic trajectory.

The findings support the endogenous growth theory, as positive shocks in FDI and education expenditure are found to have significant positive effects on real GDP per capita growth. The positive long-run effects of these variables highlight the importance of promoting foreign investment and enhancing educational opportunities to foster human capital accumulation and technological innovation, necessary for sustainable economic growth. However, negative shocks in FDI and health expenditure are found to have detrimental effects on steady state growth. The impact of positive shock in FDI is greater than that of negative shock, while positive shock in health education, although statistically insignificant, exert lesser influence than negative changes. Furthermore, the study found evidence of a marginal negative effect of trade openness on growth rate of GDP per capita, which may be attributable to unequal competition in international trade and its adverse effects on domestic industries, suggesting the need for re-evaluating trade policies. Our analysis also indicates that initial income has marginal positive effects on steady state growth, suggesting that the Nigerian economy could on a path towards steady state growth.

5.2 Recommendations

Based on the findings of this study, some key policy recommendations are proposed. Firstly, there is a need for proactive measures to attract foreign direct investment, including the creation of a conducive investment climate and the implementation of targeted incentives. Secondly, it is important to increase and prioritize government expenditure on education and healthcare to enhance human capital and improve health conditions, respectively. Thirdly, it is important to re-evaluate trade policies with the view to striking a balance between openness and protection of local industries to ensure that domestic industries have the opportunity to compete and grow, while benefitting from the advantages of international trade. Finally, policies aimed at economic diversification and reducing over-reliance on oil should be implemented to support long-term economic growth in Nigeria.

Overall, this study sheds light on the long-run drivers/determinants of steady state economic growth in Nigeria and provides policy insights to guide decision-making. The study suggests that policies aimed at increasing FDI, education expenditures, and trade openness, while also maintaining high levels of health expenditures and gross domestic income, are likely to lead to sustainable steady state economic growth in Nigeria. However, further research may be needed to delve deeper into the mechanisms through which these drivers operate and to explore additional factors that may influence Nigeria's economic trajectory.

Appendix 1: Estimated NARDL model assuming asymmetric regressors

ARDL Long Run Form and Bounds Test

Dependent Variable: D(GDP)

Selected Model: ARDL(4, 1, 1, 1, 4, 4, 1, 2, 1, 4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.1158	0.0280	-4.1322	0.0001
(FDI+)(-1)	0.0020	0.0006	3.0913	0.0033
(FDI-)(-1)	-0.0035	0.0006	-5.6655	0.0000
(EDX+)(-1)	-0.0026	0.0012	-2.2202	0.0310
(EDX-)(-1)	0.0023	0.0004	6.5282	0.0000
(HEX+)(-1)	-0.0725	0.0541	-1.3404	0.1862
(HEX-)(-1)	-0.4802	0.1579	-3.0408	0.0038
(TRD+)(-1)	0.0001	0.0001	1.2141	0.2304
(TRD-)(-1)	-0.0002	0.0000	-4.9890	0.0000
GDI(-1)	0.0360	0.0067	5.4011	0.0000
D(GDP(-1))	0.3024	0.0769	3.9318	0.0003
D(GDP(-2))	0.2137	0.0821	2.6037	0.0121
D(GDP(-3))	0.1942	0.0870	2.2322	0.0301
D(FDI+)	0.0092	0.0012	7.6098	0.0000
D(FDI-)	0.0037	0.0012	3.0776	0.0034
D(EDX+)	0.0002	0.0021	0.1008	0.9201
D(EDX-)	0.0085	0.0011	7.9322	0.0000
D((EDX-)(-1))	-0.0015	0.0010	-1.4343	0.1577
D((EDX-)(-2))	-0.0016	0.0010	-1.5541	0.1265
D((EDX-)(-3))	-0.0021	0.0010	-2.0421	0.0464
D(HEX+)	-0.5138	0.1768	-2.9067	0.0054
D((HEX+)(-1))	0.3553	0.1339	2.6528	0.0107
D((HEX+)(-2))	0.2325	0.1132	2.0548	0.0451
D((HEX+)(-3))	0.3372	0.1097	3.0743	0.0034
D(HEX-)	-1.8925	0.1869	-10.1259	0.0000
D((TRD+))	0.0007	0.0002	3.0973	0.0032
D((TRD+)(-1))	-0.0002	0.0002	-1.4475	0.1540
D((TRD-))	0.0008	0.0001	6.9871	0.0000
D(GDI)	-0.0655	0.0075	-8.7696	0.0000
D(GDI(-1))	0.0193	0.0053	3.6255	0.0007
D(GDI(-2))	0.0205	0.0054	3.7767	0.0004
D(GDI(-3))	0.0216	0.0055	3.8940	0.0003
C	0.0069	0.0013	5.2981	0.0000
R-squared	0.9999	Akaike info criterion		-13.0813
Adjusted R-squared	0.9999	Schwarz criterion		-12.1196
S.E. of regression	0.0003	Durbin-Watson stat		1.9771
Sum squared resid	0.0000	F-statistic		27490.3100
Log likelihood	575.8753	Prob(F-statistic)		0.0000

Appendix 2: Estimated NARDL model distinguishing symmetric and asymmetric regressors

Dependent Variable: D(GDP)

Automatic-lag linear regressors (4 max. lags): EDX TRD GDI

Automatic-lag dual non-linear regressors (4 max. lags): FDI HEX

Selected model: ARDL(4,4,1,4,1,4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.1841	0.0236	-7.8068	0.0000
EDX(-1)	0.0016	0.0003	5.4303	0.0000
TRD(-1)	-0.0001	0.0000	-4.4330	0.0000
GDI(-1)	0.0367	0.0061	.9708	0.0000
FDI+(-1)	0.0029	0.0007	4.3907	0.0001
FDI-(-1)	-0.0022	0.0005	-4.3351	0.0001
HEX+(-1)	-0.0785	0.0565	-1.3909	0.1702
HEX-(-1)	-0.9384	0.1192	-7.8715	0.0000
D(GDP(-1))	0.3547	0.0761	4.6584	0.0000
D(GDP(-2))	0.2698	0.0858	3.1433	0.0028
D(GDP(-3))	0.2583	0.0848	3.0476	0.0036
D(EDX)	0.0061	0.0008	7.6929	0.0000
D(EDX(-1))	-0.0010	0.0008	-1.2960	0.2007
D(EDX(-2))	-0.0009	0.0008	-1.1369	0.2608
D(EDX(-3))	-0.0010	0.0008	-1.3443	0.1847
D(TRD)	0.0007	0.0001	9.8944	0.0000
D(GDI)	-0.0618	0.0078	-7.9761	0.0000
D(GDI(-1))	0.0166	0.0052	3.1570	0.0027
D(GDI(-2))	0.0179	0.0054	3.2848	0.0018
D(GDI(-3))	0.0191	0.0055	3.4769	0.0010
FDI+	0.0075	0.0011	6.8561	0.0000
FDI-	0.0060	0.0009	6.7573	0.0000
HEX+	-0.7056	0.1115	-6.3264	0.0000
HEX-	-1.8089	0.1783	-10.1435	0.0000
D(HEX+(-1))	0.2696	0.1058	2.5492	0.0138
D(HEX-(-1))	0.4109	0.1456	2.8229	0.0067
D(HEX+(-2))	0.3212	0.1087	2.9547	0.0047
D(HEX-(-3))	0.2797	0.1470	1.9029	0.0626
D(HEX+(-3))	0.4443	0.1109	4.0062	0.0002
D(HEX-(-3))	0.1974	0.1483	1.3315	0.1888
C	0.0082	0.0012	6.7456	0.0000

R-squared	0.92004	Akaike info criterion	-12.9180
Adjusted R-squared	0.87391	Schwarz criterion	-12.0146
S.E. of regression	0.00033	Durbin-Watson stat	1.6482
Sum squared resid	0.00001	F-statistic	19.9449
Log likelihood	567.0959	Prob(F-statistic)	0.0000

Appendix 3: Estimated Short Run Coefficient and ECM

Dependent Variable: D(GDP)

Automatic-lag linear regressors (4 max. lags): EDX TRD GDI

Automatic-lag dual non-linear regressors (4 max. lags): FDI HEX

Selected model: ARDL(4,4,1,4,1,4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM(-1)	***-0.1841***	***0.0176***	***-10.4852***	***0.0000***
D(GDP(-1))	0.3547	0.0686	5.1730	0.0000
D(GDP(-2))	0.2698	0.0770	3.5045	0.0009
D(GDP(-3))	0.2583	0.0709	3.6457	0.0006
D(EDX)	0.0061	0.0007	9.0030	0.0000
D(EDX(-1))	-0.0010	0.0007	-1.4393	0.1553
D(EDX(-2))	-0.0009	0.0007	-1.2741	0.2076
D(EDX(-3))	-0.0010	0.0006	-1.6001	0.1149
D(TRD)	0.0007	0.0001	11.3126	0.0000
D(GDI)	-0.0618	0.0063	-9.7561	0.0000
D(GDI(-1))	0.0166	0.0045	3.6894	0.0005
D(GDI(-2))	0.0179	0.0046	3.8772	0.0003
D(GDI(-3))	0.0191	0.0045	4.2126	0.0001
D(FDI+)	0.0075	0.0010	7.8249	0.0000
D(FDI-)	0.0060	0.0008	7.9913	0.0000
D(HEX+)	-0.7056	0.0932	-7.5702	0.0000
D(HEX-)	-1.8089	0.1479	-12.2343	0.0000
D((HEX+)(-1))	0.2696	0.0933	2.8895	0.0054
D((HEX-)(-1))	0.4109	0.1311	3.1340	0.0027
D((HEX+)(-2))	0.3212	0.0962	3.3379	0.0015
D((HEX-)(-2))	0.2797	0.1319	2.1206	0.0382
D((HEX+)(-3))	0.4443	0.0937	4.7441	0.0000
D((HEX-)(-3))	0.1974	0.1307	1.5110	0.1361
C	0.0082	0.0007	10.9606	0.0000

R-squared	0.9200	Akaike info criterion	-13.0867
Adjusted R-squared	0.8889	Schwarz criterion	-12.3872
S.E. of regression	0.0003	Durbin-Watson stat	1.6482
Sum squared resid	0.0000	F-statistic	29.5171
Log likelihood	567.0959	Prob(F-statistic)	0.0000

References

Abdouli, M., & Hammami, S. (2017). The impact of FDI inflows and environmental quality on economic growth: an empirical study for the MENA countries. Journal of the Knowledge Economy, 8(1), 254-278.

Ajide, K. B. (2014). Determinants of economic growth in Nigeria. CBN Journal of Applied Statistics (JAS), 5(2), 8.

Akinlo, A. E. (2004). Foreign direct investment and growth in Nigeria: An empirical investigation. Journal of Policy Modeling, 26(5), 627-639.

Alam, W., Ikram, F., Kumar, P., Haseeb, M., & Ali, N. (2022). Asymmetric Effects of Foreign Direct Investment on Economic Growth: Fresh Evidence from India Using NARDL Simulation. Millennial Asia, 09763996221122205.

Amin, A., Anwar, S., & Liu, X. H. (2022). Outward foreign direct investment and economic growth in Romania: Evidence from non-linear ARDL approach. International Journal of Finance & Economics, 27(1), 665-677.

Ampofo, G. K. M., Cheng, J., Asante, D. A., & Bosah, P. (2020). Total natural resource rents, trade openness and economic growth in the top mineral-rich countries: New evidence from nonlinear and asymmetric analysis. Resources Policy, 68, 101710.

Anda, M. I., Gabriela, B., Nicolae, E., & Rehman, A. (2023). Economic Growth Drivers in Romania: Evidence from a NARDL Analysis. Sustainability, 15(7), 5916.

Asongu, S. A., & Odhiambo, N. M. (2020). Foreign direct investment, information technology and economic growth dynamics in Sub-Saharan Africa. Telecommunications Policy, 44(1), 101838.

Atilgan, E., Kilic, D., & Ertugrul, H. M. (2017). The dynamic relationship between health expenditure and economic growth: is the health-led growth hypothesis valid for Turkey?. The European Journal of Health Economics, 18, 567-574.

Bakare, A. A., & Olubokun, S. (2011). Health care expenditure and economic growth in Nigeria: An empirical study. Journal of emerging trends in economics and management sciences, 2(2), 83-87.

Borensztein, E., De Gregorio, J., & Lee, J. W. (1998). How does foreign direct investment affect economic growth?. Journal of International Economics, 45(1), 115-135.

Brueckner, M., & Lederman, D. (2018). Inequality and economic growth: the role of initial income. Journal of Economic Growth, 23(3), 341–366. https://www.jstor.org/stable/48700616

Choong, C. K., Yusop, Z., & Soo, S. C. (2005). Foreign direct investment and economic growth in Malaysia: The role of domestic financial sector. The Singapore Economic Review, 50(02), 245-268.

Daly, H. E., & Farley, J. (2011). Ecological economics: Principles and applications. Island Press

Darku, A. B., & Yeboah, R. (2018). Economic openness and income growth in developing countries: a regional comparative analysis. Applied Economics, 50(8), 855-869.

Dobson, A., Lodge, D., Alder, J., Cumming, G. S., Keymer, J., McGlade, J., & Xenopoulos, M. A. (2006). Habitat loss, trophic collapse, and the decline of ecosystem services. Ecology, 87(8), 1915-1924..

Egoh, B. N., O'Farrell, P. J., Charef, A., Gurney, L. J., Koellner, T., Abi, H. N., ... & Willemen, L. (2012). An African account of ecosystem service provision: Use, threats and policy options for sustainable livelihoods. Ecosystem services, 2, 71-81..

Elwasila S. E. M. (2017a). Resource gaps, foreign capital flows and economic growth in Sudan: An empirical econometric analysis. African Journal of Economic and Sustainable Development 6: 292–316.

Farouq, I. S., Sulong, Z., Ahmad, A. U., Jakada, A. H., & Sambo, N. U. (2020). The effects of economic growth on financial development in Nigeria: Interacting role of foreign direct investment: An application of NARDL. Int J Sci Technol Res, 9, 6321-6328.

Hye, Q. M. A., & Lau, W. Y. (2015). Trade openness and economic growth: empirical evidence from India. Journal of Business Economics and Management, 16(1), 188-205.

Islam, M. S., & Alam, F. (2022). Influence of human capital formation on the economic growth in Bangladesh during 1990–2019: an ARDL approach. Journal of the Knowledge Economy, 1-18.

Jahantabi Nejad, A., & Golkhandan, A. (2023). The Effect of Positive and Negative Public Health Expenditure Shocks during Business Cycles on Health Status in Iran. Journal of healthcare management, 13(4), 87-102.

Jiang, W., & Wang, Y. (2023). Asymmetric Effects of Human Health Capital on Economic Growth in China: An Empirical Investigation Based on the NARDL Model. Sustainability, 15(6), 5537.

Jiang, Y., Batool, Z., Raza, S. M. F., Haseeb, M., Ali, S., & Zain Ul Abidin, S. (2022). Analyzing the asymmetric effect of renewable energy consumption on environment in STIRPAT-Kaya-EKC framework: a NARDL approach for China. International Journal of Environmental Research and Public Health, 19(12), 7100.

Koojaroenprasit, S. (2012). The impact of foreign direct investment on economic growth: A case study of South Korea. International Journal of Business and Social Science, 3(21).

Kumari, R., Shabbir, M. S., Saleem, S., Yahya Khan, G., Abbasi, B. A., & Lopez, L. B. (2023). An empirical analysis among foreign direct investment, trade openness and economic growth: evidence from the Indian economy. South Asian Journal of Business Studies, 12(1), 127-149.

Liang, C., Shah, S. A., & Bifei, T. (2021). The role of FDI inflow in economic growth: Evidence from developing countries. Journal of Advanced Research in Economics and Administrative Sciences, 2(1), 68-80.

Lucas, R. E. (1990). Why doesn't capital flow from rich to poor countries? The American Economic Review, 80(2), 92-96.

Malam, B., Abba, B., & Hassan, A. (2018). The determinants of long run economic growth in Nigeria. Asian Economic and Financial Review, 8(1), 1-9.

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. The Quarterly Journal of Economics, 107(2), 407-437. doi: 10.2307/2118477

Marquez-Ramos, L., & Mourelle, E. (2019). Education and economic growth: an empirical analysis of nonlinearities. Applied Economic Analysis.

Miles, D., Scott, A. & Breedon, F (2013). Macroeconomics. Understanding the global economy. John Wiley & Sons ltd.

Mohamed, E. S. (2022). Female Human Capital and Economic Growth in Sudan: Empirical Evidence for Women’s Empowerment. Merits, 2(3), 187-209.

Mohamed, E. S. (2020). Resource rents, human development and economic growth in Sudan. Economies, 8(4), 99.

Nakhli, M. S., & Gaies, B. (2021). Political risk and financial development in Nigeria: can credit buy social peace?: evidence from NARDL approach. The Quarterly Review of Economics and Finance, 82, 55-62.

Odugbesan, J. A., Sunday, T. A., & Olowu, G. (2021). Asymmetric effect of financial development and remittance on economic growth in MINT economies: an application of panel NARDL. Future Business Journal, 7(1), 39.

Ojo, T. J., & Ojo, S. I. (2022). Health expenditure, education and economic growth in Nigeria. Open J Soc Sci Humanities (ISSN: 2734-2077), 3, 01-17.

Ozturk, I. (2008). The role of education in economic development: a theoretical perspective. Available at SSRN 1137541.

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

Pesaran, M. H., Smith, R. J., & Im, K. S. (2014). Nonlinear panel unit root tests and panel cointegration models. In Econometrics and Economic Theory: Essays in Honour of Takeshi Amemiya (pp. 139-165). Cambridge University Press.

Pesaran, M.H., Shin, Y. & Smith, R.J. (1997). Estimating long-run relationships in dynamic heterogeneous panels. DAE Working Papers Amalgamated Series 9721. Available at http://www.eprg.org.uk/faculty/pesaran/ardl.pdf.

Qi, D., Ali, A., Li, T., Chen, Y. C., & Tan, J. (2022). An empirical analysis of the impact of higher education on economic growth: The case of China. Frontiers in Psychology, 13, 959026.

Raghupathi, V., & Raghupathi, W. (2020). Healthcare expenditure and economic performance: insights from the United States data. Frontiers in public health, 8, 156..

Rahman, P., Zhang, Z., & Musa, M. (2023). Do technological innovation, foreign investment, trade and human capital have a symmetric effect on economic growth? Novel dynamic ARDL simulation study on Bangladesh. Economic Change and Restructuring, 56(2), 1327-1366.

Rodrik, D. (1998). Why do more open economies have bigger governments?. Journal of Political Economy, 106(5), 997-1032.

Romer, P. M. (1986). Increasing returns and long-run growth. Journal of Political Economy, 94(5), 1002-1037.

Romer, P. M. (1990). Endogenous technological change. Journal of Political Economy, 98(5, Part 2), S71-S102. doi: 10.1086/261725

Schorderet, Y. (2003). Asymmetric Cointegration. University of Geneva, Switzerland.

Sethi, N., Mohanty, S., Das, A., & Sahoo, M. (2020). Health Expenditure and Economic Growth Nexus: Empirical Evidence from South Asian Countries. Global Business Review, 0(0). https://doi.org/10.1177/0972150920963069

Sohail, H. M., & Li, Z. (2023). Nexus among foreign direct investment, domestic investment, financial development and economic growth: a NARDL approach in Pakistan. International Journal of Economics and Business Research, 25(2), 249-269.

Solow, R. (1956). A contribution to the theory of economic growth. The Quarterly Journal of Economics, 70(1), 65-94. doi: 10.2307/1884513

Squalli J, & Wilson K (2011) A new measure of trade openness. World Econ 34(10):1745–1770

Sriyana, J., & Afandi, A. (2020). Asymmetric effects of trade openness on economic growth in selected ASEAN countries.

Supattra, M. & ÖZER, M. (2018). Determinants of Economic Growth in Southeast Asian Countries: Bayesian Model Averaging Approach. 4TH International students Social Sciences Congress

Suryandaru, R. A. (2023). The Relationship Between Public Debt, Trade Openness, and Economic Growth in Indonesia: Symmetric and Asymmetric Analysis. Thailand and The World Economy, 41(1), 35-60.

Swan, T. W. (1956). Economic growth and capital accumulation. Economic Record, 32(2), 334-361. doi: 10.1111/j.1475-4932.1956.tb00434.x

Tchamyou, V. S., Asongu, S. A., & Odhiambo, N. M. (2019). The Role of ICT in Modulating the Effect of Education and Lifelong Learning on Income Inequality and Economic Growth in Africa. African Development Review, 31(3), 261–274. doi:10.1111/1467-8268.12388

Udeagha, M. C., & Ngepah, N. (2021). The asymmetric effect of trade openness on economic growth in South Africa: a nonlinear ARDL approach. Economic Change and Restructuring, 54(2), 491-540.

Wacziarg, R., & Welch, K. H. (2008). Trade liberalization and growth: New evidence. The World Bank Economic Review, 22(2), 187-231.

Xia, L., Ali, A., Wang, H., Wu, X., & Qian, D. (2022). A dynamic analysis of the asymmetric effects of the vocational education and training on economic growth, evidence from China. Frontiers in Psychology, 13, 888969.

Yu, C., Nataliia, D., Yoo, S. J., & Hwang, Y. S. (2019). Does trade openness convey a positive impact for the environmental quality? Evidence from a panel of CIS countries. Eurasian Geography and Economics, 60(3), 333-356.

Zainal, N. E., Salleh, S. A., Hasnorrul Hadi, N. A., Roslan, N. I. S., Abd Aziz, A. H., & Ahmad Fadzil, A. S. (2023). Exploring the drivers of poverty line income in Malaysia.