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Capital Formation and Economic Growth in Nigeria

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Abstract

To investigate how capital formation impacts GDP growth in Nigeria, the Autoregressive Distributed Lag (ARDL) approach is employed. Annual time series data from 1971–2023, inclusive, was used for the analysis. In Nigeria, gross fixed capital formation (physical capital) had a short-term negative impact on real GDP growth and a long-term positive but insignificant effect. It was also shown that regular government expenditure on healthcare and education (human capital formation) had a negative and statistically significant impact on Nigeria's real GDP growth in the long run, but a short-term negative and statistically negligible effect. Not only that, but the results showed that the working-age population had a tiny but favourable impact on real GDP growth in the short run, and a considerable and beneficial influence in the long term. There was a positive and statistically significant relationship between government external debt and real GDP growth over the long and medium term. It was also shown that interest rates had a negative impact on real GDP growth in the long run but had no influence in the short run. Government priorities should include efficient and open investment in vital sectors like agriculture and infrastructure, in line with long-term development objectives. Spending less on administrative costs and more on high-quality initiatives that build human capital is how the government should restructure its healthcare and education budgets.

Keywords: *Capital, Education, GDP, Health, Lending Rate*

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Background to the Study

The expansion of the economy is a goal of macroeconomics. It suggests that the rate of expansion in gross domestic product (GDP) and the capacity for productive work will change. The promotion of economic growth is a crucial macroeconomic objective, especially for emerging countries. Picardo argues that the pace of economic growth throughout time is the best indicator of an economy's production capacity (2020). As a country's economy grows, its revenue and production levels rise. In addition to reducing poverty, a thriving economy increases incomes, increases employment opportunities, and broadens people's access to goods and services (Eboh, Aduku, & Onwughalu, 2022). Economic growth has several benefits, including a higher standard of life, more power, and more respect. Increasing the rate of capital formation is one way to grow the economy.

A modern economy's capacity to create capital is a critical component in its overall growth rate. A nation's economic "capital formation" consists of its infrastructure, technology, machinery, and the human and material skills and knowledge of its citizens. Investments represented by tangible goods can only advance at a faster rate if capital is created (Adewunmi, 2019). Abramovitz (1956) and Denison (1967) are just two of the many renowned economists who have pointed to the fast advancement of technology and the increase in physical and human capital as main causes of economic growth. Capital formation can also be seen as encompassing the development of both human and physical capital. A thriving economy can't depend just on producing physical capital; it also needs to be good at managing and amassing human capital. Its formation has been widely acknowledged as a development catalyst, since the rise of modern industrialised nations may be attributed, in great part, to the accumulation and improvement of human capital. Increasing numbers of individuals are coming to the realisation that a nation's human capital is its most valuable asset. Human and material capital are truly sacrificed for when an economy chooses to invest in its stock instead of spend it on short-term or recurrent pleasures (Onwiodiokit, & Otolorin, 2021).

If agricultural and consumer product production rises in tandem with capital development, developing countries can reduce the impact of inflation to some extent. Better outputs, better living standards, more jobs, and more money in the bank are the results of capital accumulation (Onwiodiokit, & Otolorin, 2021). Economic growth is influenced by the level of capital formation, which in turn defines the national production capacity. It has been established that the main obstacle to long-term economic expansion is the lack of capital generation. It should come as no surprise that contemporary empirical macroeconomics places a heavy emphasis on the study of capital production. First, there needs to be actual savings; second, there needs to be credit and financial institutions to mobilise resources and channel them where they need to go; and third, there needs to be an interaction between these two factors for capital creation to occur (Nweke, Idenyi, and Anoke, 2017). Investment of these savings is the third need. Credit and the mobilisation of savings and deposits are examples of financial services that are thought to boost capital accumulation, which should lead to faster economic growth. Investments in machinery and other capital equipment that enhances production do not constitute the majority of capital formation. Capital formation supports technological innovation, boosts specialisation, and creates employment

opportunities, all of which allow economies to attain economies of scale in production. The development of human capital is facilitated by the means, tools, and strategies that are provided by capital production. Two other advantages of capital development are the extension of markets and the rectification of their defects (Taraki & Arslan, 2018). Building up a stock of capital is crucial to a flourishing economy because it increases output and the supply of goods and services. When the public and private sectors invest in a country's physical infrastructure—its buildings, equipment, and computers—the country's capacity to generate products and services is boosted. Since more products and services may be produced, this is good news for GDP growth in the long term. The people who work on capital projects also get paid, and when they buy things with that money, it boosts the economy and drives growth. Capital formation also includes expenditure on necessities like healthcare and education. When workers are well-informed and physically fit, they are able to do more, which boosts economic growth.

Problem Statement

No country can achieve long-term sustainable economic growth and development without investing heavily in capital formation. As a result, increasing capital formation has taken precedence in the race for global economic growth. Nigeria has attempted to increase capital creation through a variety of means, including encouraging investment, encouraging savings, developing infrastructure, and attracting foreign direct investment. The Contributory Pension Scheme was established by the 2004 Pension Reform Act, which was one of the laws that required people to save money for their retirement. The program has raised a substantial quantity of money that can be used for future infrastructure and other project expenditures. Another strategy for attracting FDI was the establishment of investment promotion policies, such as the Nigerian Investment Promotion Commission (NIPC). To encourage foreign direct investment (FDI) in vital industries like energy, agriculture, and manufacturing, these policies provide incentives including tax rebates and duty-free equipment imports. Also, in 2017, the Economic Recovery and Growth Plan (ERGP) was launched with the intention of diversifying the economy, expanding opportunities in various sectors, and encouraging domestic investment and capital formation. The electricity sector, transport infrastructure, public-private partnerships (PPP), and the Nigerian Stock Exchange (NSE), currently known as the Nigerian Exchange Group (NGX), have all undergone reforms.

One of Nigeria's major challenges in creating capital is low domestic savings, which has remained despite many policies and attempts throughout the years. Many Nigerians, particularly those in lower income groups, find it difficult to save money due to rising living costs, poor salaries, and high poverty rates. There is less domestic capital available for investment as a result of low savings rates, making it difficult for businesses and the government to finance growth-boosting projects. The country's ongoing power, transportation, and communication infrastructure deficit discourages private investment and limits total capital formation. This is because capital projects become riskier and more expensive as a result. Inadequate funding for healthcare and education has led to a workforce that is unprepared to innovate and boost productivity, which in turn has stifled human capital accumulation. Constant concerns about regulatory red tape, bureaucratic roadblocks, and a

lack of suitable tax incentives discourage investment. The country's prospects of raising living standards and decreasing poverty have been diminished due to the poor, sluggish, and unpredictable growth of the Nigerian economy. According to African Economic Outlook (2024) and VerivAfrica (2024), Nigeria's economic growth rate over the past decade has been a far more modest 1-3 percent, in contrast to other developing nations such as Vietnam, Ethiopia, and Bangladesh, who have all had growth rates of 5 to 7 percent. Caused by a shortage of investment, this situation necessitates investigation into the link between capital formation and GDP growth.

Many empirical research (Abina & Mogbeyiteren, 2021; Onwioduokit, Inam, & Otolorin, 2019; Adewunmi, 2019; Meyer & Sanusi, 2019; Ajose & Oyedokun, 2018; Emeka, Idenyi, & Nweze 2017) have looked into the relationship between capital formation and economic growth in Nigeria. It differs from other empirical examinations that have been conducted in the field. In addition to physical capital stock, which has been the focus of most prior research, this study also looks at human capital generation, an important part of capital production for economic growth. Capital formation's real worth and effect on economic growth are underappreciated when physical stocks are the only thing considered. In light of the foregoing, this study sets out to disaggregate data in order to examine the impact of capital formation on GDP growth in Nigeria.

Study Objectives

The fundamental objective of this study is to determine the relationship between capital accumulation and GDP growth in Nigeria. We want to do the following in particular:

i. Examine the relationship between buildup of physical capital and GDP growth in Nigeria
ii. Figure out the relationship between human capital accumulation and GDP growth in Nigeria.

Conceptual Literature

Capital Formation

Capital formation is defined by Ajose and Oyedokun (2018) as the process by which a nation enhances its social and economic infrastructure and increases its physical capital stock. The investment in a new facility along with all the required machinery, tools, and productive capital goods led to this outcome. It is like a nation's physical capital stock increasing as a consequence of investments in social and economic infrastructure, according to Ugwuegbe and Uruakpa (2013). Gbenga and Adeleke (2013) also offered a definition of capital creation, arguing that it includes the accrual of capital assets through the efficient application of a country's existing material and human resources. Adewunmi provides a more thorough analysis of the concept (2019). His perspective is that in order to increase the stock of material and human capital, capital development must first release some of society's preexisting resources for use.

Both human capital and gross fixed capital contribute to total capital formation. Gross Fixed Capital Formation is a macroeconomic concept that is included in official national accounts.

According to statistics, it's a way to find out how much fixed assets were bought by governments, businesses, and "pure" households (i.e., families that do not own any enterprises in their names) and how much they were sold for. As a component of GDP expenditure, GFCF reveals the share of new value that is invested instead of consumed by the economy. One reason GFCF is called "gross" is because it does not compensate for fixed capital consumption (fixed asset depreciation) when viewing investment data. A nation's wealth is built upon its people's knowledge, skills, and experience, which can be acquired and enhanced through human capital production. Thus, investing in people and helping them develop into productive and creative assets is what creates human capital (Onwiodiokit & Otolorin, 2021).

Economic Growth

Another way that Okumoko (2006) defines economic growth is as the rate of increase in the real gross domestic product. In order to calculate GDP, one must add up all of a country's final commodities and services that were produced and spent within a specific time period, often one year. Growth in the economy is defined by an increase in national gross domestic product and per capita income (Gallo, 2012). But according to Tombofa (2015), economic growth is the gradual increase in a country's production capacity. When evaluating economic growth on a global scale, real GDP is considered the benchmark. One easy way to look at a country's economic health is to look at its GDP, or gross domestic output. This study uses real GDP growth as a percentage of GDP as its economic growth metric.

Investment, or capital formation, increases production and quickens economic growth. The connection between the two is as follows. It propels technical advancement and has a huge effect on the economy's ability to produce. Capital formation is critical, according to economic theory, and this is true independent of the growth model. As a result, it establishes the local production capability. Therefore, a key obstacle to economic progress is inadequate capital accumulation. This is why policymakers have always been interested in what drives growth in capital formation.

Theoretical Literature

The Augmented Solow Human-Capital-Growth Theory

Mankiw, Romer, and Weil's (1992) enhanced Solow theory of human capital growth forms the basis of this analysis. By incorporating human capital, Mankiw, Romer, and Weil's 1992 hypothesis built upon the initial Solow's growth model. It is believed that the economy will grow quicker if money is invested in people. It is based on the premise that formal education increases output. According to human capital theory, getting a degree is the first step towards becoming more productive and joining the modern global economy. The premise asserts that individuals with more education are more productive. Workplace efficiency and production are boosted by human capital, which encompasses both intrinsic abilities and investments in employees' professional growth (Basil, Nwokoye, & Aduku, 2021). The human capital of a country is its most valuable asset. Human capital development is laid forth in the notion. Based on the work of Eigbiremolen and Anaduaka (2014), the following model was proposed by Basil, Nwokoye, and Aduku (2021):

$$Y = AK^{a}(hl)^{\beta} \qquad (1)$$

The variables Y, K, and h stand for growth, physical capital stock, and human capital level, respectively. The labour force, total human capital stock, and total factor productivity are represented by L, hl, and A, respectively. In terms of output, a represents the elasticity of capital input, and β represents the elasticity of labour input.

Empirical Literature

In their study of the effect of Gross Fixed Capital Formation on GDP growth in East African Community countries, Achar, Luther, Ochieng, and Odhiambo (2024) provided an example of empirical research in this field. Research was conducted from 2000 to 2022 inclusive. The data was analysed using the pooled OLS Estimation technique. It was concluded that the rate of gross fixed capital formation affected the rate of economic growth. Using the Harrod-Domar Model, Dumo, Ico, and Magpantay (2023) sought to determine the relationship between total capital formation and GDP growth in the Philippines. The research was conducted from 1981 to 2021 inclusive. The data was analysed using Ordinary Least Squares (OLS). The correlation between savings, total capital formation, and GDP growth was positive and statistically significant.

Onwiodiokit and Otolorin (2021) investigated the relationship between capital production and GDP growth in Nigeria. The study analysed data from 1981 through 2018. Information was examined by means of Dynamics Ordinary Least Square (DOLS). The correlation between GDP growth and gross fixed capital creation was found to be negative and statistically significant. It was also found that total labour force and debt both impeded economic expansions. Tareef and Shawaqfeh (2019) investigated a number of factors influencing capital development in a selection of Arab states. The research looked at six Arab countries: Bahrain, Egypt, Saudi Arabia, Jordan, and Morocco. The study's subjects were panel data collected between 1978 and 2016. The research used the generalised least squares technique (GLSM) for its statistical analysis. The findings indicate that government spending leads to an increase in capital stock.

Foreign direct investment (FDI), capital formation (CF), and GDP growth were the relationships that the Nigerian economists Emeka, Idenyi, and Nweze (2017) investigated. The research covered the years 1981–2016. For this data analysis, we consulted the Error Correction Mechanism and the Granger causality test. There has been no correlation between the increase in domestic investment and the rate of gross fixed capital formation in Nigeria, the paper states. How did Nigeria's external debt impact the country's capacity to develop capital? Abdullahi, Hassan, and Bakar evaluated this in 2016. Their investigation encompassed the years 1980 to 2013 and was conducted using Autoregressive Distributed Lag (ARDL) modelling techniques. Their empirical study shows that external debt has a major detrimental effect on capital formation. The only variable that was shown to have a bidirectional causal influence on capital creation was savings; factors like external debt and capital formation were found to have unidirectional effects.

Bal, Dash, and Subhasish (2016) used autoregressive distributed lag (ARDL) regression methods to look at the impact of capital production on India's economic growth from 1970 to 2012. Capital formation and economic growth were among the control variables that demonstrated a long-run relationship, according to the data. In the near term, GDP is hurt by inflation, but in the long run, growth is helped by factors including factor productivity, trade openness, capital formation, and exchange rates. If the government promotes capital development, the authors argue, the growth rate can be increased.

Methodology.

Research Design

These are variables that are measured across time. This led the researchers to use a time series methodology in their investigation. In order to conduct time series research, one must first gather, analyse, and understand time series data. Researchers using a time-series research design track the same variable(s) across the stages of the investigation. It is common practice to gather data and draw conclusions during a study's duration.

Model Specification

First, we want to see how human capital formation affects economic growth; second, we want to see how physical capital formation affects economic growth. Here is the model's functional form for goals one and two:

$$GDPG = GFCF, HCF, \text{WAPOP}, \text{DEBT}, \text{INTR} \qquad (1)$$

Where:
GDPG = real gross domestic product growth rate, a measure for economic growth
GFCF = gross fixed capital formation, a measure for physical capital formation
HCF = human capital formation, measured by total of government recurrent expenditure on health and education
WAPOP = working age population
DEPT = government external debt
INTR = interest rate, measured by the lending rate

Equation (1) follows the respecification of the variables in autoregressive distributed lag (ARDL) form as:

$$GDPG = \alpha_0 + \alpha_1 GDPG_{t-1} + \alpha_2 logGFCF + \alpha_3 logHCF + \alpha_4 log\text{WAPOP} + \alpha_5 log\text{DEBT} + \alpha_6 \text{INTR} + \sum_{j=1}^{p} \phi_j GDPG_{t-j} + \sum_{s=0}^{q} \rho_s logGFCF_{t-s} + \sum_{m=0}^{q} \delta_m logHCF_{t-m} + \sum_{z=0}^{q} \psi_z log\text{WAPOP}_{t-z} + \sum_{z=0}^{q} \vartheta_z log\text{DEBT}_{t-z} + \sum_{z=0}^{q} b_z \text{INTR}_{t-z} + \mu_{1t} \qquad (2)$$

The various elements in equation (2) represent variables with a short time horizon, whereas the lag terms denote variables with a lengthy time horizon. The variables' long-run and short-

run parameters are denoted as ϕ,ρ, δ,φ, and ϑ, respectively, while ⟦ μ⟧ _1t is the error term and a⟧ _i (i = 1, 2, 3, …6) is the short-run parameter. For this purpose, you should employ the Akaike information lag length selection approach.

One of the key benefits of this model is its small sample characteristic. The model's utility may persist regardless of whether the regressors are stationary at I(0), I(1), or both. When variables are adjusting to a state of equilibrium, as shown by cointegration, an error correction model can be used to represent this process. This model is defined as:

$$\Delta GDPG = a_0 + \sum_{j=1}^{p} \phi_j GDPG_{t-j} + \sum_{s=0}^{q} \rho_s logGFCF_{t-s} + \sum_{m=0}^{q} \delta_m logHCF_{t-m} + \sum_{z=0}^{q} \psi_z log\mathrm{WAPOP}_{t-z} + \sum_{z=0}^{q} \vartheta_z log\mathrm{DEBT}_{t-z} + \sum_{z=0}^{q} b_z \mathrm{INTR}_{t-z} + \gamma ECM1_{t-1} + \mu_{12t}$$

Where $\mathrm{ECM1}_{t-1}$ is the error correction term

Definition of the Variables in the Model

Here we define the variables used in the models.

When stated as a percentage, a country's GDP growth rate shows how quickly its GDP has increased (or decreased) between two accounting periods. An essential indicator of economic well-being, this rate documents variations in the value of products and services generated over time. Gross Fixed Capital Formation (GFCF) is the net investment in fixed assets (assets utilized in the long-term production of commodities and services) by a nation or economy. Infrastructure, machinery, equipment, buildings, and other long-term assets that boost economic productivity are the main targets of GFCF investments.

Human capital formation (HCF) can be measured, for example, by the proportion of GDP spent on healthcare and education. The government spends a total of this amount on operational costs related to healthcare and education. In the health and education industries, recurrent spending is a constant, non-capital expense that is inherent to daily operations. One measure of a country's financial health is its external debt, or the portion of its overall debt that originates from entities outside the country, such as other governments, corporations, or financial institutions. It is the total amount of money owed by a nation to entities outside of its borders. The people who are actively seeking employment are referred to as the working population (WPOP).

A loan's or savings account's interest rate is the percentage of the principal amount charged or paid each year in relation to that total. Key to economic activity, consumer behaviour, and investment decisions, it is called the "cost of borrowing" or "return on investment" and is an important part of finance. The lending rate is used as a metric for this study. Interest rates charged by financial institutions to those who take out loans are known as the lending rate. Interest rates vary depending on loan types, borrower creditworthiness, and economic conditions; they indicate the cost of borrowing money. The impact of lending rates on consumer spending, business investment, and total growth makes them crucial to the economy.

Results and Discussion

Descriptive Statistics of the Variables

The variables' features, such as their mean and skewness, were investigated using descriptive statistics. On Table 1, you can see the projected outcomes of these descriptive statistics.

Table 1: Descriptive Statistics

Variables	Obs.	Mean	Standard Deviation	Minimum value	Maximum value	P-value (Skewness)	P-value (Kurtosis)
GDPG	53	3.3963	5.4709	-13.1278	15.3291	0.0368	0.0681
GFCF	53	8965.335	17283.21	50.198	82889.22	0.0000	0.0000
HCF	53	257.1143	339.1234	0.2449	1221.615	0.0001	0.0882
WAPOP	53	52100000	25000000	10200000	99600000	0.8682	0.1104
DEBT	53	2992.016	6283.225	2.3312	38219.85	0.0000	0.0000
INTR	53	19.6185	8.2767	6.0000	36.0900	0.3318	0.0126

Source: Estimated by the researcher

It appears that economic growth and interest rates were rather constant throughout the research period, as real GDP growth averaged 3.39% and rates were 19.62%. In addition, the statistics for physical capital, which includes gross fixed capital formation, human capital, which includes government recurrent expenditure on health and education, the working-age population, and government external debt were 8,965.34 billion, 257.11 billion, 52.1 million, and 2,992.02 billion, respectively. According to the data, these are the average effects of these factors for the entire sampling period.

There is moderate variability in real GDP growth, government recurrent expenditure on health and education (representing human capital formation), and interest rate, with standard deviations of 5.4709, 339.1234, 6,283.225, and 8.2767, respectively. The fact that these variables' values cluster around their means indicates that they are highly constant throughout the research period. In contrast, both the working-age population (standard deviation: 25,000,000) and gross fixed capital formation (standard deviation: 17,283.21), which is a measure of physical capital, exhibit substantial variance. The high standard deviations relative

to the mean values of these variables show that they changed substantially throughout the sample period, suggesting significant dispersion.

Gross fixed capital formation (physical capital) had the lowest recorded value at 50.198 billion, followed by government recurrent expenditure on health and education at 0.2449 billion, the working-age population at 10.2 million, and government external debt at 2.3312 billion. A similar interest rate of 6% and a real GDP growth rate of 13.1278 percent were also recorded. Nevertheless, at 82,889.22 billion, 1,221.615 billion, 99.6 million, and ₦38,219.85 billion, respectively, were the top levels of the working-age population, government external debt, gross fixed capital creation, and government recurrent expenditure on health and education. The highest interest rate recorded was 36.09%, while the real GDP growth rate reached 15.32%. If the minimum value of a variable is less than the mean and the highest value is more than the mean, then the distribution of that variable is symmetrical about the mean. This provides more evidence that there were no outliers in the dataset used for the study.

All four of these variables—government recurrent expenditure on health and education (representing human capital formation), gross fixed capital formation (a proxy for physical capital), and real GDP growth—had statistically significant probability values at the 5% level when compared to skewness. We can thus reject the null hypothesis of normal distribution because the distributions of these variables are not symmetrical and are skewed, positively or adversely. On the other hand, the probability values for the interest rate and the working-age population did not deviate from zero at the 5% level, thus we cannot rule out the possibility of normalcy. That being the case, we can presume a normal distribution for these two variables.

Interest rate, gross fixed capital formation (physical capital), and government foreign debt were discovered to be associated to kurtosis at the 5% level of significance. The extremes of the tails' weights indicate that these variables' distributions are not normal; so, we reject the null hypothesis of normally distributed kurtosis. This provides more evidence that the relevant variables deviate from the expected distribution. Human capital formation (government recurrent investment on health and education), real GDP growth, and the working-age population did not have a kurtosis probability value at the 5% level of significance. It is not possible to reject the null hypothesis of normal kurtosis since these variables exhibit distributional properties that are compatible with a normal distribution.

Lag Order Selection

Finding the optimal lag duration required the application of the Akaike Information Criterion (AIC). The most appropriate and statistically significant value was found to be two seconds, as shown in Table 2. Given this, lag 2 was the optimal lag structure for the models employed in this study.

Table 2: Lag Order

Lag	LL	LR	df.	P	AIC	HQIC	SBIC
0	-2612.59				102.69	102.777	102.917
1	-2376.39	472.38	36	0.000	94.839	95.447	96.4299*
2	-2318.66	115.47*	36	0.000	93.9866*	95.1156*	96.9411

Source: Estimated by the researcher

Unit Root Test

The stationary status of the time series variables used in the models was checked using two tests: The Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP). The outcomes of these tests are shown in Table 3.

Table 3: Augmented Dickey-Fuller and Philips–Perron unit root test results

Variable	Augmented Dickey-Fuller Result		Philips–Perron Result		Lag order	Order of Integration
	Level	1st Difference	Level	1st Difference	Lag	Order of Integration
GDPG	-2.503	-4.430	-2.660	-6.627	1	I(1)
logGFCF	-2.457	-3.878	-2.327	-6.290	1	I(1)
logHCF	-2.057	-4.161	-2.214	-7.402	1	I(1)
logWAPOP	-1.147	-4.348	-1.298	-7.343	1	I(1)
logDEBT	-2.656	-4.704	-2.698	-7.691	1	I(1)
INTR	-1.613	-4.259	-2.805	-9.995	1	I(1)
When the null hypothesis that there is no unit root is rejected, the symbol * indicates significance at the 5% level. Using Akaike's Information Criteria (AIC), we determined that a lag length of 2 would be ideal. In contrast to the -3.504 observed at the first difference, the ADF 5% critical value at levels is -3.500. At levels and the first difference, the Philips -Perron critical values are -3.498 and -3.499, respectively. Unit root test models generated by Augmented Dickey -Fuller and Philips -Perron both incorporated a trend.						

Source: Estimated by the researcher

The Augmented Dickey-Fuller (ADF) test found that all variables had test statistics that were less than the 5% critical values, suggesting that there is no statistical significance at the 5% level. The level form variables cannot be considered stationary since the null hypothesis does not rule out the possibility of a unit root. We corrected this by running the stationarity tests again at the stage of variable differentiation. It is clear from the test statistics that they were more than the 5% critical values; so, we can reject the unit root hypothesis and demonstrate that the variables are stationary at first difference. Even though the variables were non-stationary before first differencing, the Phillips-Perron (PP) test reveals that they became stationary after that, which agrees with the ADF results.

Impact of Physical and Human Capital Formation on Economic Growth

The first two goals' models were estimated to look at how people and physical capital formation affect GDP growth. The first step of the analysis was to use the Bounds test to see if the variables in the model for goals one and two were level-form related (cointegrated). View Table 4.

Table 4: Bounds test result for the variables in the model for objectives one and two

	10%		5%		1%		p-value	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F	2.351	3.707	2.823	4.355	3.931	5.862	0.007	0.009
t	-2.458	-3.755	-2.815	-4.178	-3.535	-5.025	0.001	0.008
F = 4.704								
t = -4.833								

Source: Author's computation

A computed F-statistic of 6.705 surpasses both the lower critical bound of 2.823 and the upper critical bound of 4.355 at the 5% level of significance. Since it is greater than the upper bound, we may reject the null hypothesis that there is no level relationship and instead conclude that the variables are cointegrated. Additional evidence of cointegration may be seen in the fact that the t-statistic's absolute value (-4.833) is greater than the lower and upper critical t-values (-2.815 and -4.178, respectively) at the 5% level. Statistical significance of the p-values for both the level (order 0) and first-differenced (order 1) variables allows us to reject the null hypothesis for the order 1 variables.

Table 5 shows that there is evidence of cointegration, which supports your estimate of the error correction model (ECM).

Table 5: Error correction estimates of the ARDL model for objectives one and two

The dependent variable is industrial production as a share of GDP (ISPGDP), a measure for industrial sector development				
EDEV	coefficients	Standard Errors	t-Statistics	P-value
Adjustment	-0.9480	0.2187	-4.33	0.000
Long-Run				
logGFCF	1.8341	1.0708	1.71	0.096
logHCF	-2.2003	0.9634	-2.28	0.029
logWAPOP	3.3885	1.3285	2.55	0.016
logDEBT	3.5204	1.1841	2.97	0.005
INTR	-0.5866	0.2909	-2.02	0.052
Short-Run				
$GDPG_{t-1}$	-0.1201	0.1564	-0.77	0.448
logGFCF	-1.5181	5.4355	-0.28	0.782
logHCF	-0.8216	1.0302	-0.80	0.431
logWAPOP	3.0397	2.2285	1.36	0.182
logDEBT	2.2891	0.7079	3.23	0.003
INTR	0.0571	0.2149	0.27	0.792
Constant	-68.0728	28.5396	-2.39	0.023
R-squared			0.6645	
Adjusted R-Squared			0.4916	
Durbin–Watson d-statistic (18, 51)			2.1886	
Breusch–Pagan/Cook – Weisberg test for heteroskedasticity			0.16 (p = 0.6863)	

Source: Author's computation

The results showed a t-value of -4.33 and an error correction adjustment coefficient of -0.9480. If there is short-run disequilibrium, the model's variables revert to long-run equilibrium at a substantial adjustment speed of 94.80% per annum, as evidenced by the statistically significant negative coefficient of -0.9480. When there are disruptions to the economy, it usually takes about a year for things to get back to normal.

Physical capital, also known as gross fixed capital formation, has a long-run coefficient of 1.8341 (t=1.71). Physical capital, also known as gross fixed capital creation, has no discernible effect on real GDP growth; this conclusion is supported by the 5% level of significance, as the t-value is not statistically significant. More specifically, while gross fixed capital production (physical capital) increased, real GDP growth grew by a tiny 1.83 percent. There was no statistically significant short-term effect (t=-0.28 and r=-1.5181) on the outcome. Due to an increase in physical capital, real GDP growth slowed by a little margin of 1.52%. This suggests that physical capital, also known as gross fixed capital formation, had a small and negative impact on real GDP growth in the short term. Fundamentally, physical capital, also known as

gross fixed capital creation, has a tiny positive influence on real GDP growth over the long run and a tiny negative effect on real GDP growth over the near term.

A t-value of -2.28 and a long-term coefficient of -2.2003 were recorded for human capital formation, which encompasses government expenditure on healthcare and education. Since the t-value is statistically significant, rejecting the null hypothesis at the 5% level, it may be concluded that human capital accumulation does, in fact, significantly impact economic growth in Nigeria. Government increased its recurring expenditure on healthcare and education, which lowered real GDP growth by 2.20 percent (human capital formation). Government recurring spending on healthcare and education (human capital accumulation) also showed a negative coefficient of -0.8216 and a non-significant t-value of -0.80 in the short run. Since the t-value is not statistically significant, we accept the null hypothesis that human capital formation does not significantly affect economic growth in Nigeria at the 5% level. Government recurrent investment on health and education (human capital formation) increased, which resulted in real GDP growth that was 0.82 percentage points lower. This suggests that government recurrent spending on healthcare and education (human capital formation) had a negative impact on long-term real GDP growth, but had a smaller but nonetheless negative effect on short-term real GDP growth.

A t-value of 2.55 and a long-term coefficient of 3.3885 were calculated for the working-age population. A coefficient with statistical significance has been found. This means that the working-age population does have a considerable impact on Nigeria's economic growth, contrary to the null hypothesis, which we reject at the 5% level. Over the long run, a rise in the working-age population resulted in a real GDP growth rate that was 3.39 percent greater. Working population coefficient 3.0397 and t-value 1.36 are observed in the short run. The t-value does not justify a 5% rejection of the null hypothesis. This shows that even though the number of people in the labour force increased, the actual GDP growth was quite little in the short run. Thus, while the working-age population did contribute somewhat to real GDP growth in the short run, they did so in a positive and substantial way over the long term.

A t-value of 2.97 and a long-run coefficient of 3.5204 characterize the government's external debt. We may reject the null hypothesis that there is no relevant association between government external debt and real GDP growth at the 5% level since the t-value is statistically significant. Research shows that a rise in the national debt causes a 3.52 percent increase in real GDP growth. Even in the short run, things looked good and were statistically significant (t=3.23, coefficient= 2.2891). A rise in the government's external debt caused the real growth rate of GDP to be 2.29 percent higher. So, in the short term, the government's external debt had a positive and substantial impact on real GDP growth. Both the long- and short-term effects of government external debt on real GDP growth were positive and statistically significant.

The interest rate's t-value was -2.02 and its coefficient was -0.5866 during the long run. The statistical significance of the t-value allows us to reject the null hypothesis that interest rates do not significantly affect GDP growth in Nigeria at the 5% level. Specifically, a rise in the interest

rate caused a 0.59 percentage point slowdown in real GDP growth. A t-value of 0.27 and a positive coefficient of 0.0571 for the interest rate in the short run are deemed insignificant. The t-value is not statistically significant at the 5% level of significance; hence we accept the null hypothesis that interest rates do not significantly affect economic growth in Nigeria. Real GDP growth was only slightly affected by the interest rate hike, raising it by only 0.06 percent. This shows that interest rates had a huge and negative impact on real GDP growth in the long run, but had little impact in the short run.

The coefficient of determination, or R2, is 0.6645. In other words, the independent variables account for 66.45 percent of the variation in the real GDP growth rate in Nigeria over the long and medium term. Other variables that explain the residual percentage change in the real GDP growth rate are not included in the model. Based on the findings, the Durbin-Watson test of autocorrelation yielded a coefficient of 2.1886. Because it is so near to 2, we accept as true the null hypothesis that there is no autocorrelation among the independent variables. According to this, there is no significant autocorrelation. The Breusch-Pagan/Cook - Weisberg test for heteroskedasticity yielded a coefficient of 0.16, and the p-value was 0.6863. Due to the non-significant p-value at the 5% level, the null hypothesis demonstrating homoskedasticity is accepted. Put simply, there is no change in the variance of the variables.

Conclusion

The study concluded that the current level of human and physical capital development in Nigeria did not significantly contribute to economic growth during the period under consideration. According to the positive but limited long-run impact of gross fixed capital creation, physical investments have the potential to raise GDP. However, these investments may be impeded by inefficiency, faulty execution, or inappropriate targeting. Consistent public expenditure on healthcare and schools also has substantial negative effects in the long term. Spending on human capital has apparently not resulted in any growth or improved productivity. This can be due to a preference for recurring spending over developmental spending or a misallocation of resources. As a consequence of these findings, Nigeria's public investment policy needs a major overhaul if the government wants its investments in human and material resources to have a greater positive effect on development.

The growth of Nigeria's economy is also affected by financial and demographic variables, both of which can be somewhat unpredictable. A large and beneficial influence of the working-age population on real GDP growth over the long run suggests that human resources, when utilised well, can drive economic progress. Given the short-term insignificance, it is possible that inefficiencies in the job market are to blame for the lack of immediate impact. High borrowing costs restrict growth, as seen by the long-term impact of the interest rate on economic growth. Nevertheless, the impact was insignificant in the near term. Government foreign debt, an important source of growth-enhancing capital, significantly and positively affected GDP growth in the short and long run, indicating that it can be managed properly. Increasing Nigeria's economic growth in the long term can be achieved by promoting fair job opportunities, carefully managing the country's external debt, and maintaining an interest rate environment that is favourable to growth, according to the research.

Recommendations

It is suggested that you consider the following options:

i. In line with development objectives for the long term, the government should put an emphasis on investing in infrastructure and agriculture in an open and efficient manner.
ii. Health and education expenditures should undergo government reform by reducing wasteful spending on administration and increasing funding for high-quality services that increase the productivity of human capital.
iii. To capitalise on the expanding pool of people of working age, the government should support initiatives to increase employment opportunities and improve people's skill sets.

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