



IMPACT OF PUBLIC-PRIVATE INVESTMENT INTERACTION ON ECONOMIC GROWTH: EVIDENCE FROM NIGERIA

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ABSTRACT: This study explored the interaction between private and public investments and its effect on economic growth in Nigeria over the period 1986 to 2021. The analysis utilized annual time series data, including real Gross Domestic Product (GDP), private investment (proxied by gross fixed capital formation), public investment (proxied by government capital expenditure), exchange rate, and interest rate spread. The Autoregressive Distributed Lag (ARDL) Bounds Testing approach was employed to examine the existence of both short-run and long-run relationships among the variables. The objective was to assess the effect of the interaction between private and public investment on economic growth. The empirical results revealed that the model variables were cointegrated, suggesting a stable long-term equilibrium relationship. Furthermore, the interaction between private and public investments were found to have a statistically significant impact on economic growth in both the short run and the long run, highlighting the complementary nature of these investment types. The study recommends that government policy should focus on enhancing the synergy between public and private investment through the provision of critical infrastructure at reduced economic costs. Also the creation of a business-friendly environment fosters sustainable economic growth in Nigeria.

KEYWORDS: Private and public investment, economic growth, real gross domestic product, ARDL, Nigeria.



INTRODUCTION

Most countries, including Nigeria, desire rapid and sustainable growth of their economies. One of the major tools at the disposal of any nation for achieving rapid and sustainable economic growth is investment. To achieve meaningful growth, therefore, countries, especially the developing ones, may not have any other option than to invest seriously and adequately. Investment, according to Coen and Eisher (1992), is defined as capital formation – the acquisition or creation of resources to be used in production. Less developed countries (LDCs) like Nigeria face fundamental challenges of how to achieve a large increase in output over a long period of time and improve the standard of living of the citizens to have a dramatic change in their economic, political and social conditions. Investment can be undertaken by government, non-profit institutions and households, and it includes the acquisition of human and intangible capital as well as physical capital; it is an important component of aggregate demand as well as a leading source of economic growth. Jongwanich and Kohpaiboon (2008) observed that change in investment not only affects aggregate demand but also enhances the productive capacity of an economy. Higher investment rate triggers economic growth. Investment, however, exists in two major components – public investment and private investment – in an economy.

Public investment by federal, state, and local governments builds the capital stock of a nation by devoting resources to the basic physical infrastructure (such as roads, bridges, rail lines, airports, and water distribution), innovative activity (basic research), green investments (clean power sources and weatherization), and education (both primary and advanced, and also job training) that lead to higher productivity and/or higher standards of living. Private actors also invest in these areas, but to a much smaller degree, in part because the gains from public investment accrue not only to those undertaking the investment, but equally to a wide range of people and businesses. According to Levine and Renelt (1992), investment in capital goods is the most robust and vital determinant of economic growth. Gross domestic investment boosts economic growth by way of increasing physical capital directly and indirectly through technological spillovers.

Economic growth, often proxied by GDP, as Balami (2006) noted, refers to an increase in output of an economy's capacity to produce goods and services needed to improve the welfare of the country's citizens. Growth is meaningful when the rate of growth is much higher than population growth because it has to lead to improvement in human welfare. Therefore, growth is seen as a steady process of increasing the productive capacity of the economy and, hence, of increasing national income, being characterized by higher rates of increase of per capita output and total factor productivity. This study therefore carried out economic analysis of private and public investment interactions on economic growth in Nigeria for the period 1986–2021. Public

investments by federal, state, and local governments play a critical role in expanding a nation's capital stock. Governments allocate significant resources to developing and maintaining essential physical infrastructure – such as roads, bridges, rail lines, airports, and water distribution systems – which forms the backbone of economic activity. In addition, public funds support innovative endeavours through basic research, invest in green technologies like clean power sources and weatherization projects, and bolster educational systems spanning primary, secondary, and advanced levels, as well as vocational training. These investments not only enhance productivity but also contribute to improved living standards across society.



While private sector investments also target these sectors, their scale is generally more limited. This is partly because the benefits of public investment are widespread, accruing to a broad range of individuals and businesses, rather than exclusively to those who invest directly. As noted by Levine and Renelt (1992), investment in capital goods is one of the most robust and vital determinants of economic growth. Gross domestic investment propels economic expansion both by directly increasing the stock of physical capital and indirectly through technological spillovers that encourage further innovation. Economic growth, often measured by GDP, reflects an economy's increased capacity to produce the goods and services needed to enhance the welfare of its citizens (Balami, 2006). Meaningful growth is achieved when the rate of output expansion surpasses population growth, leading to higher per capita incomes and improved human welfare. In light of this, the present study aims to conduct an economic analysis of the interplay between private and public investment and its impact on Nigeria's economic growth between 1986 and 2021. The study poses the research question: What is the effect of private and public investment interactions on Nigeria's economic growth? Its primary objective is to analyse how these interactions influence the nation's economic performance. Specifically, the study aims to determine the impact of combining private and public investments on Nigeria's growth. To guide this inquiry, the following null hypothesis is tested:

H₀: The interaction between private and public investments does not have a significant impact on Nigeria's economic growth.

The Concept of Public Investment

Public investment is primarily carried out by the government and focuses largely on social and economic infrastructure, although it can also include non-infrastructure projects. According to Blejer and Khan (1984), public investment can be divided into infrastructural and non-infrastructure categories, with infrastructure investments generally complementing private investment. In contrast, non-infrastructure government investments may not have the same synergistic effect. Balasa (1988) found a negative relationship between private and public investment across 30 countries. This inverse relationship might be due to limited access to capital for private investors and increased competition in the market for finished goods. Heavy taxation on private investors can further exacerbate this issue by raising product prices, potentially discouraging consumer patronage in favour of more moderately priced alternatives.

The Concept of Private Investment

Private investment, according to Kumo (2006), refers to investment by private business for the purpose of profit generation. Adekunle and Aderemi (2012) noted that real domestic investment is expenditure made to increase the total capital stock in an economy by acquiring further capital-producing assets and assets that can generate income within the domestic economy. Physical assets particularly add to the total capital stock. Boosting economic development requires higher rates of economic growth than savings can provide. Part of the finance for investment is provided by the corporate sector; bank loans and households' savings make up the other part. With this, savings is no longer a constraint to investment demand. While short-term investments are highly encouraged by external sources of funds, long-term investments are more domestically driven. This is one of the reasons why aid is less effective in the long run. With lower rates of interest, asset values tend to be on the upward swing which invariably represents the discounted value of such assets, thereby increasing the rate of acquisition and investment in such assets increases aggregate demand. Investment therefore is



not constrained by aggregate savings but more by domestic interest rates. Therefore, the new equation of investment is $\text{Investment} = (\text{Savings}) + (\text{newly created money available to Deposit Money Banks})$. Attempts at reducing expenditure have affected investment rates and have led to poor and sluggish growth, eventually affecting savings performance (Khan Villanueva, 1991).

Keynes Theory of Investment

Keynes (1936) advanced his theory of investment based on ‘animal spirits.’ He stated that despite the fact that investment and savings must be identical *ex-post*, savings and investment decisions are generally taken by different decision-makers; hence, there was no reason why *ex-post* savings should equal *ex ante* investments. Keynes formulated an investment function of the form $I = I_0 + i(r)$, where I is investment, I_0 is autonomous investment and $i(r)$ is interest rates. Investment is inversely proportional to interest rates. The higher the interest rate, the less likely the firm will be willing to undertake any given investment project. In this regard, Keynes stated that firms rank various investment projects depending on the internal rate of return (IRR), or marginal efficiency of investment. Given a certain rate of interest, firms would choose projects whose IRR exceeded the rate of interest. The criticism of this theory was that ranking of investments may most likely be dependent on interest rates.

LITERATURE REVIEW

Theories of Economic Growth

Neoclassical Model of growth

The Neoclassical Model of Growth was first devised by Robert Solow. The model believes that a sustained increase in capital investment increases the growth rate only temporarily. This is because the ratio of capital to labour goes up (there is more capital available for each worker to use) but the marginal product of additional units of capital is assumed to decline and the economy eventually moves back to long-term growth path, with real GDP growing at the same rate as the workforce plus a factor to reflect improving “productivity”. A “steady-state growth path” is reached when output, capital and labour are all growing at the same rate, so output per worker and capital per worker are constant. Neoclassical economists believe that to raise an economy’s long-term trend rate of growth requires an increase in the labour supply and an improvement in the productivity of labour and capital. Differences in the rate of technological change are said to explain much of the variation in economic growth between developed countries. The neoclassical model treats productivity improvements as an exogenous variable, meaning that productivity is assumed to be independent of capital investment (IMF, 2001).

Empirical Literature

Enya and Ezeali (2021) examined public investment in infrastructure and the economic growth of Nigeria. The study adopted econometric analysis using E-View. The stationarity test carried out in the study showed that all the variables were all stationary at first difference, $I(1)$ and, because of that, the researchers proceeded to determine evidence of cointegration among the variables. Hence, the result of the cointegration test showed that there was evidence of 2 cointegration equations, which showed that there was a long-run relationship among the



variables. The ECM test was well signed having -0.019307 with a good adjusted coefficient of determination of 92.78%, with a joint statistical probability of 0.00000. The study had it that public investment in technology, educational infrastructure and power all had a positive relationship with the economy, whereas transport had a negative relationship with the economy. The study went further to conclude that public investment played important roles in stimulating the Nigerian economy, especially in this era of democracy.

Garikai and Nicholas (2019) examined the relative contribution of public and private investment to economic growth in Malawi from 1970 to 2014 using the recently developed autoregressive distributed lag model (ARDL) bounds testing procedure. They also examined the crowding-out or crowding-in effect of public investment on private investment. Unlike most previous studies on that subject which were cross-sectional in nature, this study examined the differential impacts of public and private investment on economic growth focusing on Malawi. The main finding of the study was that private investment contributes more to economic growth than public investment. The variables PCGDP, PINV, PUINV, RIR, and INFLA attained stationarity after first differences. The Johansen cointegration test of trace and maximum Eigenvalue statistics was used to establish a long-run equilibrium relationship among the variables in the model. The over parameterized and parsimonious ECM were estimated to account for short-run dynamic adjustment required for a stable long-run equilibrium relationship among the variables in the model. All the independent variables (PUINV, PINV, RIR, INFA) impacted positively on economic development. Public and private investments conformed to a priori expectations while inflation and real interest rate contradicted a priori expectations. The analysis suggested a high degree of macroeconomic stability and low predictable inflation rates have a paramount importance to ensure a strong response to private investment to economic incentives.

METHODOLOGY

Theoretical Framework

The theoretical underpinning of this study is based on the Solow-Swan aggregate production function, as utilized in the works of Ghura (1997) and Beddies (1999). To assess the impact of both private and public investment on economic growth in Nigeria, the model is adapted to incorporate three key types of capital stock: private capital, government (public) physical capital, and human capital. The modified Solow-Swan production function thus serves as the analytical foundation for capturing the individual and combined effects of these forms of capital on national output. The production function takes the form:

$$Y_t = A_t(K_t^p)^\alpha (K_t^g)^\beta (Z_t^p)^\gamma \quad Z_t = L_t \text{ and } HL_t \quad (3.1)$$

where Y is output; A represents technology; K^p and K^g are the private and government physical capital stocks, respectively; Z represents labor (L) adjusted for human capital development

(HL_t); and t is a time index. Equation (3.1) can be expressed in growth rate terms as follows:

$$y = a + \alpha K^p + \beta K^g + \gamma K^z \quad (3.2)$$



where a small letter for a variable denotes its growth rate. Equation (3.2), which represents a long-run economic growth relationship, can be estimated, provided that data are available for capital stocks. Unfortunately, such data are typically unavailable for developing economies, including Nigeria. Nevertheless, Equation (3.2) can be transformed into an estimable form as Equation (3.3) by making some simplifying assumptions regarding physical capital stocks.

$$y = a + \alpha PIY_t + \beta GIY_t + \gamma HL_t + \varpi PIY_t + \varepsilon_t \quad (3.3)$$

where

Y = real output

A = technological progress

K^P = private physical capital stock

K^g = public physical capital stock

Z = labor force (L) augmented by human capital development HL , and

t = time index.

The parameters α , β , and γ = elasticities of output with respect to private, government, labor force and human capital stocks respectively.

Model Specification

Following from Equation (3.3) above, the model for this study is expressed as follows:

$$RGDP = f(PRINV, PUBINV, PRINV*PUBINV, EXCH, INTR) \quad (3.4)$$

where

$RGDP$ = real gross domestic product (proxy for economic growth)

$LNPRINV$ = private investment (proxied by Gross Fixed Capital Formation)

$LNPUINV$ = public investment (proxied by Government Capital Expenditure)

$LNPRINV*LNPUINV$ = interactive term (for private and public investment Interaction)

$EXCH$ = exchange rate

$INTR$ = interest rate spread

$\beta_1 - \beta_7$ = parameters to be estimated for each independent variable.

U = error term

A priori: $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$, $\beta_5 < 0$.

All the variables in Equation (3.4), with the exception of exchange rate and interest rate, are transformed into logarithmic form to reduce them to the same form and also to maintain the



growth status. Interest rate and exchange rate are already in rates and therefore not logged. Equation (3.4) is further expressed in econometric form thus:

$$\begin{aligned} \text{LNRGDP} = & \beta_0 + \beta_1 \text{LNPRINV} + \beta_2 \text{LNPUBINV} + \beta_3 \text{LNPRINV} * \text{LNPUBINV} \\ & + \beta_4 \text{EXCH} + \beta_5 \text{INTR} + U \end{aligned} \quad (3.5)$$

This is to be estimated as ARDL model specified in Equation (3.6):

$$\begin{aligned} \text{LNRGDP} = & \beta_0 + \beta_1 \text{LNPRINV}_{t-1} + \beta_2 \text{LNPUBINV}_{t-1} + \beta_3 \text{LNPRINV}_{t-1} * \text{LNPUBINV}_{t-1} \\ & + \beta_4 \text{EXCH}_{t-1} + \beta_5 \text{INTR}_{t-1} + \sum_{i=1}^k \delta_{1i} \Delta \text{LNRGDP}_{t-1} + \sum_{i=1}^k \delta_{2i} \Delta \text{LNPRINV}_{t-1} \\ & + \sum_{i=1}^k \delta_{3i} \Delta \text{LNPUBINV}_{t-1} + \sum_{i=1}^k \delta_{4i} \Delta \text{LNPRINV}_{t-1} * \text{LNPUBINV}_{t-1} \\ & + \sum_{i=1}^k \delta_{5i} \Delta \text{EXCH}_{t-1} + \sum_{i=1}^k \delta_{6i} \Delta \text{INTR}_{t-1} + \delta_{7i} \text{ECM}_{t-1} + \varepsilon_t \end{aligned} \quad (3.6)$$

Method of Evaluation

The method of evaluation for this work will include Unit Root Test, Co-integration Test, Error Correction Mechanism and Granger Causality Test.

Unit Root Test

To avoid the problem of spurious correlations in the regression analysis, the time-series properties of the variables used in the regression analysis are investigated using the standard augmented Dickey-Fuller (ADF) and the Phillips-Perron unit root tests under two alternative hypotheses.

Cointegration Test

Error Correction otherwise accept Mechanism (ECM)

This test is adopted to determine whether the variables have short-run relationships. The coefficient of the error term lag (1), which is the ECM, shows the speed at which the dependent variable adjusts to equilibrium in the short run; if significant and negative, it shows that the error in the previous period (long run) has been corrected and the model has returned back to equilibrium.

Subtract y_{t-1} from both sides and add and subtract $\beta_1 x_{t-1}$ from the RHS:

$$\Delta y_t = \beta_1 \Delta x_t - (1 - \alpha)(y_{t-1} - \theta x_{t-1}) + e_t$$

It shows how y_t responds, in the short run (SR), to changes in x_t and to deviations from long-run (LR) equilibrium, $(y_{t-1} - \theta x_{t-1})$. The ECM model thus shows that the growth rate in y is explained by the growth rate in x and past disequilibrium between these variables.



- $\theta_{t-1} = y_{t-1}$ or $\theta^x = \bar{y}$ is the LR equilibrium value of y . Thus, if $\alpha < 1$, then y rises when $y_{t-1} < \bar{y}$, and y falls when $y_{t-1} > \bar{y}$. This dynamic makes y to converge towards its LR equilibrium.
- $1 - \alpha$ = the speed of adjustment to the LR.

The higher α is, the faster the adjustment to new equilibrium because the faster it takes for the error to disappear.

The error correction specification requires that the variables are I(1) and co-integrated. Then their first difference is I(0), and the ECM term is I(0); hence, the error term is stationary. Thus, the spurious equation situation will no longer exist since all stochastic trends disappear. More generally:

$$\Delta y_t = \alpha_0 + \beta(y_{t-1} - \theta_{t-1}) + \sum \alpha_{yi} \Delta y_{t-i} + \sum \alpha_{xi} \Delta x_{t-i} + e_t$$

RESULTS / FINDINGS

Unit Root Test

Augmented Dickey Fuller (ADF) unit root test is conducted at 5% level of significance to verify the stationarity property of the variables in the model, whether the mean value and variances of the variables are time invariant, in other words constant over time or fixed over time, in order to avoid generating spurious regression. The null hypothesis states that the series has a unit root if t-statistic is less than the critical value at 5%; otherwise, the study rejects it. The result of the unit root test is presented in Table 4.1 below.

Table 4.1: Unit Root Test Result

Level			First Difference			
Variables	ADF Statistic	5% Critical Value	ADF Statistic	5% Critical Value	Remarks	Rank
LNRGDP	-0.431234	-2.948404	-4.934456	-2.951125	Stationary	I(1)
LNPRINV	-1.251888	-2.948404	-4.301417	-2.951125	Stationary	I(1)
LN PUBINV	-1.723993	-2.948404	-6.702385	-2.951125	Stationary	I(1)
PRINV_PUBINV	-1.693887	-2.948404	-5.271169	-2.951125	Stationary	I(1)
EXCH	2.239303	-2.948404	-3.908831	-2.951125	Stationary	I(1)
INTR	-0.841000	-2.948404	-6.616034	-2.951125	Stationary	I(1)

Source: Researcher's Computation from Eviews

The result showed that all the variables – Real Gross Domestic Product (RGDP); Private Investment (LNPRINV) proxied by Gross Fixed Capital Formation; Public Investment (LN PUBINV) proxied by Government Capital Expenditure; Private and Public Investment Interaction Term (LNPRINV_LN PUBINV); Exchange Rate (EXCH); and Interest Rate Spread (INTR) – in the model are integrated of order one, I(1). Thus, the result fulfilled the underlying conditions for ARDL bound testing proposed by Pesaran et al. (2001) since none



of the variables in the model is integrated of order two, $I(2)$. In view of this, the cointegration estimation is carried out using ARDL bounds test framework to test the sufficient condition for the error correction model after satisfying the stationary requirements.

Cointegration Test: ARDL Bounds Test

The result of the ARDL Bounds test performed to test for the presence of cointegration among the variables in the model is presented in Table 4.2 below.

Table 4.2: ARDL Bounds Test

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	4.570874	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Source: *Eviews 9 Regression Output*

The result showed that the computed F-Statistic for the equation is 4.570874 which exceeded the upper bounds critical value of 3.79 at 5% level of significance. The null hypothesis of no cointegration is rejected. The result therefore showed that the variables in the model are co-integrated; a long run relationship exists among variables in the model.



Model Selection Method

Table 4.3: ARDL (4, 4, 0, 0, 2, 0) Regression Model

Dependent Variable: LNRGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNRGDP(-1)	0.093527	0.250031	0.374059	0.7133
LNRGDP(-2)	0.223148	0.220981	1.009808	0.3276
LNRGDP(-3)	0.474686	0.211744	2.241787	0.0395
LNRGDP(-4)	-0.267503	0.134692	-1.986028	0.0644
LNPRINV	-0.099062	0.086912	-1.139792	0.2711
LNPRINV(-1)	-0.032342	0.110617	-0.292376	0.7738
LNPRINV(-2)	-0.169072	0.124412	-1.358964	0.1930
LNPRINV(-3)	-0.013179	0.114684	-0.114915	0.9099
LNPRINV(-4)	0.291446	0.094615	3.080327	0.0072
LNPUBINV	-0.353652	0.142183	-2.487307	0.0243
LNPRINV_LNPUBINV	0.039019	0.013210	2.953671	0.0093
EXCH	-0.001985	0.000472	-4.205297	0.0007
EXCH(-1)	-0.000496	0.000999	-0.497055	0.6259
EXCH(-2)	0.002052	0.000758	2.708856	0.0155
INTR	-0.005933	0.008835	-0.671567	0.5114
C	5.592428	1.403633	3.984251	0.0011
R-squared	0.996644	Mean dependent var	10.52367	
Adjusted R-squared	0.993497	S.D. dependent var	0.501132	
S.E. of regression	0.040412	Akaike info criterion	-3.272546	
Sum squared resid	0.026130	Schwarz criterion	-2.539678	
Log likelihood	68.36073	Hannan-Quinn criter.	-3.029621	
F-statistic	316.7396	Durbin-Watson stat	2.431011	
Prob(F-statistic)	0.000000			

***Note:** p-values and any subsequent tests do not account for model selection.

Source: *EvIEWS 9 Regression Output*

**Table 4.4: ARDL Bounds Test**

ARDL Bounds Test

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	4.656726	4

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

The ARDL bounds test for the basic model revealed that co-integration exists among the variables in the model. Therefore, to determine the impact of private and public investment on economic growth in Nigeria, we estimated the Basic Regression Model with no Interactive term using the ARDL model. The result of the Basic Regression Model with no interactive term using ARDL model presented in Table 4.6 below revealed that neither private investment nor public investment has a statistically significant impact on economic growth in Nigeria in both the short and long run within the period of the study.

**Table 4.5: ARDL Cointegrating and Long Run Form of Basic Regression Model with No Interactive Term**

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNRGDP(-1))	-0.445023	0.192307	-2.314125	0.0343
D(LNRGDP(-2))	-0.351082	0.196737	-1.784528	0.0933
D(LNPRINV)	-0.079563	0.090522	-0.878932	0.3924
D(LNPRINV(-1))	0.226022	0.132119	1.710741	0.1064
D(LNPRINV(-2))	-0.051127	0.121019	-0.422468	0.6783
D(LNPRINV(-3))	-0.210025	0.094595	-2.220249	0.0412
D(LNPUBINV)	0.043494	0.046902	0.927349	0.3675
D(EXCH)	-0.001805	0.000491	-3.674471	0.0020
D(EXCH(-1))	-0.000877	0.000925	-0.947399	0.3575
D(EXCH(-2))	-0.001486	0.000841	-1.767199	0.0963
D(EXCH(-3))	-0.000679	0.000619	-1.097697	0.2886
D(INTR)	-0.009572	0.009446	-1.013336	0.3260
CointEq(-1)	-0.240075	0.116999	-2.051939	0.0569

$$\text{Cointeq} = \text{LNRGDP} - (-0.4093 \cdot \text{LNPRINV} + 0.1812 \cdot \text{LNPUBINV} + 0.0089 \\ * \text{EXCH} - 0.0399 \cdot \text{INTR} + 13.0077)$$

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNPRINV	-0.409323	0.551574	-0.742100	0.4688
LNPUBINV	0.181170	0.248059	0.730351	0.4757
EXCH	0.008864	0.004720	1.877899	0.0787
INTR	-0.039871	0.053983	-0.738585	0.4709
C	13.007683	3.528925	3.686018	0.0020

R-squared	0.996127	Mean dependent var	10.52367
Adjusted R-squared	0.992495	S.D. dependent var	0.501132
S.E. of regression	0.043413	Akaike info criterion	-3.129270



Sum squared resid	0.030155	Schwarz criterion	-2.396402
Log likelihood	66.06832	Hannan-Quinn criter.	-2.886345
F-statistic	274.3173	Durbin-Watson stat	2.398664
Prob(F-statistic)	0.000000		

Source: *Eviews 9 Regression Output*

Interactive Regression Model

To determine whether public investment moderates' private investment in Nigeria, we estimated Interactive Regression Model presented in Table 4.3 below, using ARDL model. The result of the short-run Interactive Regression Model estimation showed that private investment and public investment interaction has a statistically significant impact on economic growth in Nigeria. The interaction between private investment and public investment is significant; their impact on economic growth in Nigeria is statistically significant as indicated by the t-statistic and probability values of the private investment and public investment interaction term of 2.953671 and 0.0093 respectively in the short run and by the t-statistic and probability values of the private investment and public investment interaction term of 4.197829 and 0.0007 respectively in the long run. In other words, evidence of a synergy impact exists between private investment and public investment; their combination is stronger than the sum of their individual impacts.

The result also indicated that there is an increase in R-squared for the model with interaction term compared to the model without interaction term. The R-squared increased from 99.6% for the model without interaction term to 99.7% for the model with interaction term. This means that the model with the interaction term helped in explaining 0.1% more of the changes in economic growth in Nigeria. This provides evidence that the model with interaction is superior to the model without interaction term.

The coefficient of the interactive term is 0.039019 in the short run and 0.081947 in the long run, and represents the increase in effectiveness of private investment for a unit change in public investment, which thus implies that one unit adjustment on the interaction term will lead to outcome variability values of 3.9% and 8.19% in real gross domestic product (proxy for economic growth) in the short run and long run respectively as against the coefficients of private investment and public investment of -0.079563 and 0.043494 respectively in the short run, and -0.409323 and 0.181170 respectively in the long run of the basic regression model that has no interaction term in both the short and long run.

The average economic growth when all variables in the model are kept constant stands at 11.745301. We included an interaction term in this model since we expect that the effect of public investment on economic growth will not be the same whether or not private investment performs. The results of ARDL Error Correction Regression in Table 4.3 above indicate that the coefficient of the short-run dynamic impact of private investment and public investment interaction and control variables in the model is negative, fractional, and statistically significant as desired. The coefficient of the error correction mechanism (ECM) is estimated at -0.476142 with a probability value of 0.0055 and t-statistic value of -3.206354. Therefore, the ECM is statistically significant and implies a speed of adjustment process of 47%.



The result further revealed that interest rate (INTR) has no significant impact on economic growth in Nigeria in both the short and long run at 5% level of significance as indicated by its t-statistic and probability values of -0.671567 and 0.5114, and -0.602889 and 0.5550 respectively. It also indicated that exchange rate has a statistically significant impact on economic growth in Nigeria in the short run as shown by its t-statistic and probability values of -4.205297 and 0.0007 respectively but an insignificant impact on economic growth in Nigeria in the long run as indicated by its t-statistic and probability values of -0.817552 and 0.4256 respectively .

Table 4.6: ARDL Cointegrating and Long-run Form

Dependent Variable: LNRGDP

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNRGDP(-1))	-0.430332	0.187058	-2.300526	0.0352
D(LNRGDP(-2))	-0.207183	0.172456	-1.201368	0.2471
D(LNRGDP(-3))	0.267503	0.134692	1.986028	0.0644
D(LNPRINV)	-0.099062	0.086912	-1.139792	0.2711
D(LNPRINV(-1))	0.169072	0.124412	1.358964	0.1930
D(LNPRINV(-2))	0.013179	0.114684	0.114915	0.9099
D(LNPRINV(-3))	-0.291446	0.094615	-3.080327	0.0072
D(LNPUBINV)	-0.353652	0.142183	-2.487307	0.0243
D(LNPRINV_LNPUBINV)	0.039019	0.013210	2.953671	0.0093
D(EXCH)	-0.001985	0.000472	-4.205297	0.0007
D(EXCH(-1))	-0.002052	0.000758	-2.708856	0.0155
D(INTR)	-0.005933	0.008835	-0.671567	0.5114
CointEq(-1)	-0.476142	0.148499	-3.206354	0.0055

$$\text{Cointeq} = \text{LNRGDP} - (-0.0466 * \text{LNPRINV} - 0.7427 * \text{LNPUBINV} + 0.0819 * \text{LNPRINV_LNPUBINV} - 0.0009 * \text{EXCH} - 0.0125 * \text{INTR} + 11.7453)$$

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNPRINV	-0.046641	0.188399	-0.247567	0.8076



LNPUBINV	-0.742746	0.179624	-4.135000	0.0008
LNPRINV_LNPUBINV	0.081947	0.019521	4.197829	0.0007
EXCH	-0.000901	0.001102	-0.817552	0.4256
INTR	-0.012461	0.020669	-0.602889	0.5550
C	11.745301	1.389630	8.452106	0.0000

R-squared	0.996644	Mean dependent var	10.52367
Adjusted R-squared	0.993497	S.D. dependent var	0.501132
S.E. of regression	0.040412	Akaike info criterion	-3.272546
Sum squared resid	0.026130	Schwarz criterion	-2.539678
Log likelihood	68.36073	Hannan-Quinn criter.	-3.029621
F-statistic	316.7396	Durbin-Watson stat	2.431011
Prob(F-statistic)	0.000000		

Source: Eviews 9 Regression Output

Post-Estimation Tests

Serial Correlation LM Test

The result presented in Table 4.9 below indicates Obs*R-squared p-value of 0.0007 which is less than 0.05. What this means is that there is a serial correlation problem in the model.

Table 4.8: Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	5.752084	Prob. F(2,14)	0.0150
Obs*R-squared	14.43424	Prob. Chi-Square(2)	0.0007

Source: Eviews 9 Regression Output

Heteroskedasticity Test

The result of heteroskedasticity test presented in Table 4.9 below also revealed that the residuals are homoskedastic. Thus, the model has no serial correlation since the Prob. Chi-Square is 0.5029 which is greater than 0.05.

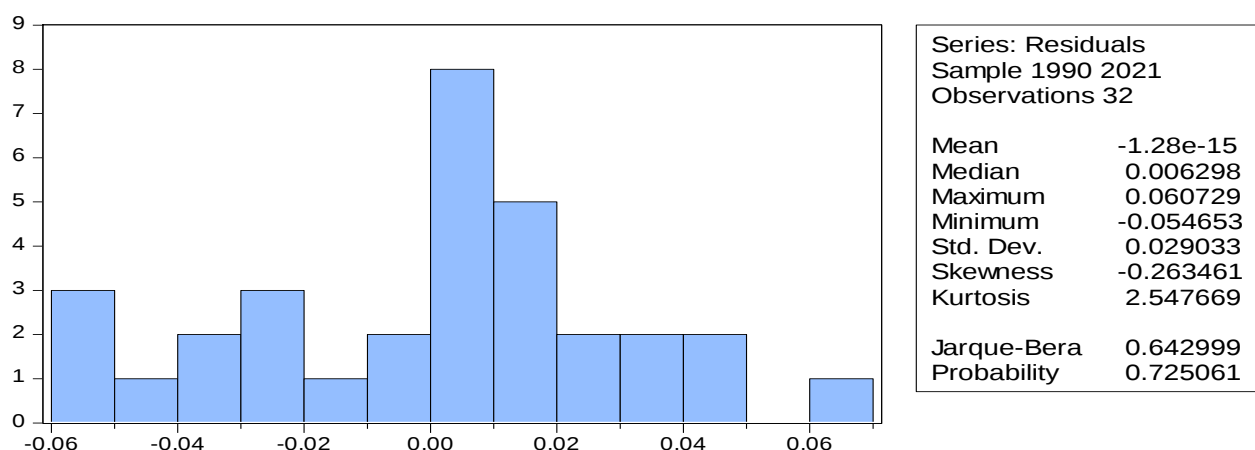
**Table 4.9: Heteroskedasticity Test**

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.861843	Prob. F(15,16)	0.6110
Obs*R-squared	14.30067	Prob. Chi-Square(15)	0.5029
Scaled explained SS	2.766588	Prob. Chi-Square(15)	0.9998

Source: *Eviews 9 Regression Output***Normality Test**

The result presented in figure 4.6 indicates that Jarque-Bera probability is 0.725061 which is greater than 0.05. This means that the residuals followed normal distribution; the assumptions of normal distribution are satisfied.

Figure 4.6: Jarque-Bera Test**Source:** *Eviews 9 Regression Output***Test of Hypotheses**

The study tested the hypothesis that private and public investment interaction has no significant impact on economic growth in Nigeria. The result indicated that private and public investment interaction has a statistically significant impact on economic growth in Nigeria over the period studied in the short run as well as in the long run.



IMPLICATION TO RESEARCH AND PRACTICE

1. Policymakers need to prioritize creating enabling environments for private investment, including regulatory reforms, access to finance, and simplified tax systems.
2. Policies that ensure inflation and interest rates remain stable are necessary for investor trust. Central bank independence and fiscal discipline become critical tools in this regard.
3. Addressing poor infrastructure, power shortages, inefficient tax systems, and connectivity issues will directly improve the ease of doing business, encouraging domestic and foreign investment.

CONCLUSION

The findings of this research suggest that a robust relationship exists between investment (both public and private) and economic growth in Nigeria. The results confirm that private investment has a more substantial impact on the country's economic growth compared to public investment, emphasizing the need for policies that foster private sector development. However, public investment in critical infrastructure, such as power and education, remains essential for long-term growth. The study also emphasizes that macroeconomic stability, including control of inflation and interest rates, is crucial for creating an environment conducive to investment.

FUTURE RESEARCH

The study recommends that the government should design investment policies to encourage the growth of private and public investment in Nigeria to include the provision of the necessary infrastructure at reduced economic cost and creation of a business environment conducive enough not only to attract private investment but for sound investment that would stimulate sustainable economic growth in the country. Government should, as a matter of necessity, adequately address the issue of poor investment climate, which includes poor infrastructure, power shortage, poor transport, poor telecom connectivity of business locations and inefficient tax administration, to promote private sector investment.

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