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EFFECT OF EXCHANGE RATE MOVEMENT ON THE NEXUS BETWEEN PUBLIC- PRIVATE INVESTMENT AND ECONOMIC GROWTH IN NIGERIA

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Abstract
This paper investigated the effect that exchange rate fluctuations can engender upon the linkage between public- private and economic growth. Data on public investment (Gross Fixed Capital Formation-Public) and private investment (Gross Fixed Capital Formation- Private) along with the exchange rate were sourced from World Development Indicators (WDI) 2020. The study adopted the Auto Regressive Distributed Lag (ARDL) model for its estimation techniques. The result shows no significant impact of exchange rate fluctuations on both the private and public investment for the study period in the long and short runs. However, the public investment has a negative and statistically significant relationship with economic growth in the long run as well as in the short run. The Federal Government of Nigeria is advised to increase infrastructural investments as a means of correcting the negative trend and come out with far reaching reforms on institutional corruption

Keywords: Auto regressive Distributed Lag, Gross Fixed Capital Formation, Private Investment, Public Investment,

1.0 Introduction

Government economic programmes all around the world are substantially influenced by the broad theory that investing in public capital and infrastructure will accelerate economic growth. On the one hand, by providing infrastructure support, public investment may encourage and enable private investment. Despite the fact that economists and policymakers agree that investment boost economic growth, they do not agree on whether public or private investment has a strong impact on economic activity or whether there is a relationship between the two. The well-known work of Aschauer (1989) stressed the value of public expenditures and noted that the decline development in the 1980s. Following this study, a growing body of literature has been published inquiring into the relationship between public and increased production growth and private capital (see Mundell, 1990; Khan & Reinhart, 1990; Barro, 1990; Easterly &

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Rebello, 1997; Tatom, 1991, 1993; Evans & Karras, 1994; Ramirez, 1998; Ligthart, 2000; Aubyn & Afons, 2008). There is significant disagreement regarding the proportional contributions of public and private investment to economic expansion. There have many previous studies on the topic mentioned above, although the majority has been conducted at the level of industrialized nations (see, for example, Aschauer, 1989); Ligthart, 2000; Aubyn & Afonso, 2008). According to the few researches that are now accessible on the topic in the developing countries, the evidence is inconsistent and contradictory (Khan & Reinhart, 1989; Khan & Kumar, 1997; Ghali, 1998).

The vast majority of studies that have looked at the relative impact of public and private investment have a number of limitations. Firstly, because private investment is an endogenous variable, the majority of earlier studies on the topic only estimate the modified production model, in which public and private investments are among the independent variables. As a result, the empirical findings of these studies are susceptible to simultaneous bias problem. In order to prove the significant crowing effect of public spending on private investment, simultaneous estimation of the private investment model is required. Secondly, some earlier research on the topic focused solely on the effect of public investment or its component parts on economic growth. Important policy implications can be drawn from an empirical study on the varied effects of public and private investment in putting together an investment mix that will help the economy grow. Finally, majority of the studies conducted at the level of developing nations (Khan & Reinhart, 1989; Khan & Kumar, 1997; Ghali, 1998) rely on cross-sectional analysis. However, it is increasingly acknowledged that grouping countries by cross-sectional based on the structural differences may make it more difficult to prescribe implications for national policy.

The desire for developing and expansion in various human endeavours and infrastructures drives most developing nations, including Nigeria, to increase public and private investment in the hope that doing so will fostet such growth. The raw materials, machineries and other apparatus required for these investments are bought from other nations, resulting in a decrease in foreign exchange reserves (Mshana, 2009). A country must rely on other nations to increase its GDP, and other investment-related instruments and supplies frequently purchased from other foreign countries with use of foreign currency reserves for their payments. This study considers the effect of exchange rate movements on the relationship between private-public investment and economic growth in Nigeria.

2.0 Literature Review

Depending on the connection between them, public and private investments each contribute differently to economic growth. Public and private investments can contribute to economic growth in separate and complimentary ways as they are mutually dependent. The relative strength of the crowding in or crowding out effect, however, determines the subsequent contribution of public and private investment to economic growth if there is a crowding effect relationship. When it is limited to the provision of essential infrastructure, as in electricity, education, transportation, and health, public investment might crowd out private investment. Government investment in these fields fosters the

development and expansion of private investment by creating an enabling environment (Berndt & Hanson, 1992). Public investment, however, has the potential to stifle private investment. Firstly, when it is deficit financed which gives up cost of capital beyond what private businesses can afford. Secondly, if it is carried out by inefficient state businesses that receive state subsidies. Thirdly, if it produces goods that directly compete with the private sector when the latter has a higher and growing efficiency in their production.

There is conflicting and inconclusive empirical evidence about the relative contributions of public and private investment to economic growth. Numerous empirical researches have produced a body of evidences demonstrating the superiority of private investment over public investment in the process of economic growth. One of such study is the early work of Khan and Reinhart (1989), who reported that, from a sample of 24 emerging economies, private investment contribute more to economic growth than public investment. When the sample size was increased to 95 developing economies, Khan and Kumah (1997), who questioned the reliability of Khan and Reinhart's data based on limited, discovered a similar result. A growing body of empirical evidence indicates that public investment is more important than private investment in the process of economic growth (Lynde, 1992; Crowder & Hamarios, 1997; Mallick, 2002; Belloc & Vertova, 2004). There are several follow up studies that reported the significance of private investment-led economic growth model (Beddies, 1999; Zou, 2006; Makuyana & Odhiambo, 2016). Nevertheless, depending on the sample and methodology, they obtained varying outcomes.

Baro and Lee (1994) used the OLS method to estimate panel data from 116 nations the years 1965 to 1985 to study the factors that influence economic growth. The findings show that political instability, huge governments, and government-caused market distortions all have a detrimental impact on economic growth. Deverajan et al (1996) used a sample of 43 industrialized and developing nations from the years 1970 to 1990 to explore the relationship between public spending and economic growth. According to their findings, public capital spending has a detrimental impact on economic growth in developing countries and the effect is significantly the opposite in industrialized countries. They propose the excessive amounts of expenditures that are typically thought of a productive could become unproductive in order to explain their findings. The dynamic impact of public investment on economic growth was calculated in a VAR framework by Mittnik and Newman (2001), with focus on six industrialized nations including the United States. The study came to the conclusion that public investment is crucial to economic growth and that cutting back public spending might be detrimental to it. The study by Naravan (2004) on Fiji demonstrates how the relationship between public and private investment has changed through time. The outcome demonstrated the presence of a tenuous long-term bond. Public investment, according to Erden and Hocombe (2005), tend to replace private ones in industrial nations but can supplement them in emerging ones. Using a panel of developing nations from 1980 to 1997, Lufti and Randall 92005) applied a number of pooled specifications of a standard investment model and discovered that public investment is associated with a 2% increase in private

investment. In addition the study discovered that while this was not true in rich economies, the availability of bank credit in developing economies restrains private investment. In developed economies, public investment displaces private investment.

2.1 Theoretical Review

In most literature, there are two types of growth models: the exogenous growth model, or the neoclassical growth model, which was initially propounded by Solow in 1956, and the new growth theory, or endogenous, which was pioneered by Romer (1986), Lucas (1988), Barro (1990) and Rebelo (1991). Economic growth has been emphasized as a significant factor in many countries for decades. As a discipline core economic growth theory was born in the late 1960s. After two decades, growth theory became popular again in the mid-1980s by the emphasis on the long-run growth, which is now called endogenous growth theory. It is understood that long-run economic growth is at least as important as short-run fluctuations of growth and in fact it is even more important than that. For instance, it might be crucial to understand why a nation's GDP increased by three or four percent over the previous few months. And understanding why African countries have much lower GDP rather than their European counterparts. The endogenous growth theory, often known as the new growth theory, emphasizes the significance of the latter questions regarding long-run economic performances over the former. Since these theories explain how long-run growth rates determined within the models rather than by a few outside variables, they are known as endogenous growth models.

Neoclassical growth theory served as a model for the creation of endogenous growth theory. Romer (1990) added imperfect competition, resource development to the growth framework. Research and development (R&D) was also taken into account by other researchers, particularly Aghion et al (1998) and Grossman and Helpmen (1991) in the growth model. Government policy cannot alter the growth rate of per capita income over the long term in neoclassical growth models, but it can affect population increase, which is thought to affect growth rate. According to these models, if fiscal policy affects incentives for saving or investing in new capital, the equilibrium capital output ratio will change, which will alter the production path while maintaining the steady state growth rate. While population increases technological advancement are external variables that drive the long term growth rate, public policy can only affect the economy's trajectory as it moves toward a steady growth rate. The proportion of public spending in production or the breakdown of spending and taxation, according to economists who favour "endogenous growth models", has an impact on the steady state growth rate (Easterly & Rebelo 1993; Stokey & Rebelo, 1995). In the neoclassical growth theory, the steady growth rate is exclusively affected by investments in physical and human capital. According to the endogenous growth model, the stability of the business environment specifically, government policies and actions regarding taxation, law, and order, the provision of infrastructure services, the protection of intellectual property rights, international trade regulation, financial markets, and other aspects of the economy, determines the long-term growth rate. As a result, the government has also provided guidance for the long-term growth rate (Barro, 1997). The endogenous model treats

investment as a crucial aspect as well. Neo classical growth model theory, as previously said, holds that investments only play a small part in driving economic growth and that an ongoing increase in the factor of production is unlikely result in growth. In accordance with the endogenous growth theory, productivity can be raised despite the law of diminishing returns. For instance, productivity rises as a result of technological advancement that is supported by capital investment. Similar to how new abilities gained greater education and training and improved health generally tend to increase labour productivity. Additionally, the endogenous growth model contends that government institution have a place in addressing any market imperfections related to the various investment kinds. Consequently, the investment is essential to encourage economic growth. In addition, endogenous growth theory suggests that economic growth is driven by advances in the technology that are made possible by investments. Consequently, the investment may have contributed to long-term growth.

3.0 Method and Data

This study used the recently developed ARDL model resting approach of cointegration introduced by Pesaran *et al* (2001) to examine the influence of exchange rate on the relationships between public-private investments. In comparison to previous cointegration approaches such as the Johansen (1988), Engle and Granger (1987) and Johansen and Juselius (1990) techniques, the ARDL cointegration approach provides a number of advantages. First whether the regressors are I (0) or I (1), the ARDL approach can be used. As a result, the ARDL technique has the benefit of avoiding the classification of variables into I (0) or I (1) and eliminating the requirement for unit root pre-testing. Second, whereas the ARDL procedure is the most statistically significant method for determining the cointegration relation in small samples, the Johansen cointegration procedure requires large data samples for validity. Third, whereas it is impossible with conventional processes, the ARDL procedure permits the variables to have several optimal delays. According Ozturk and Acaravci (2010), traditional cointegration approaches estimate the long-run relationships within a context of system equations, whereas the ARDL procedure uses a single reduced form equation. The ordinary Least Squares (OLS) estimator and an unrestricted error correction model serve as the foundation for the ARDL bounds testing methodology. The cointegration relationship in the regression equation is determined by applying bounds test to the unrestricted error correction model. The data for the variables used in this are sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin (2023) and World Development Indicators (WDI), 2023

Model Specification

The implicit equation:

*RGDPGR = f (TOT, PI, GI, DCP, EXCR, EXCR*PI, EXCR*GI)* …… (*1*)

Where RGDPGR= Real Gross Domestic Product growth rate (proxy for economic growth)

TOT = Terms of Trade

PI = Private Investment (Private Sector Fixed Capital Formation % of GDP)
GI = Public Investment (Public Sector Fixed Capital Formation % of GDP)
DCP = Domestic Credit to Private Sector (Domestic Credit to Private sector % of GDP
EXCR = Exchange Rate
EXCR * PI = Exchange Rate interaction with Private Investment
EXCR * GI = Exchange Rate interaction with Public Investment

An econometric expression of equation (1) is:

$$RGDPGR_t = \alpha + \beta_1 TOTt + \beta_2 PIt + \beta_3 GI_t + \beta_4 DCP_t + \beta_5 EXCR_t + \beta_6 (EXCR*PI)_t + \beta_7 EXCR*GI)_t + \mu_t \quad \ldots\ldots (2)$$

The Augmented ARDL version of equation (1) is:

$$\Delta RGDPGR_t = \alpha_0 + \sum_{i=1}^{a} \alpha_{1i} \Delta RGDPGR_{t-1} + \sum_{i=0}^{b} \alpha_{2i} \Delta TOT_{t-1} + \sum_{i=0}^{c} \alpha_{3i} \Delta PI_{3i} + \sum_{i=0}^{d} \alpha_{4i} \Delta GI_{4I} +$$

$$\sum_{i=0}^{e} \alpha_{5i} \Delta DCP_{t-1} + \sum_{i=0}^{f} \alpha_{6i} \Delta EXCR_{t-1} + \sum_{i=0}^{g} \alpha_{7i} \Delta (EXCR*PI)_{t-1} + \sum_{i=0}^{h} \alpha_{8i} \Delta (EXCR*GI)_{t-1} +$$

$$+\Omega_i RGDPGR_{t-1} + \Omega_i TOT_{t-1} + \Omega_i PI_{t-1} + \Omega_i GI_{t-1} + \Omega_i DCP_{t-1}$$

$$+\Omega_i EXCR_{t-1} + \Omega_i (EXCR*PI)_{t-1} + \Omega_i (EXCR*GI)_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The parameters Ω_i, where i= 1, 2, 3,4,5,6,7,8,9 are the corresponding long run multipliers, where the parameters $\alpha_1 - \alpha_8$ are the short-run dynamic coefficients of the underlying ARDL model.

4.0: Data Presentation

Descriptive Statistics

Preceding the analysis of the role of exchange rate in the nexus between private-public expenditure and economic growth, the characteristics of the variables used in the study are examined through descriptive statistics.

Table 1: Descriptive Statistics of the Variables

	DCP	EXCR	EXCRGI	EXCRPI	GI	PI	RGDPGR	TOT
Mean	9.455	112.223	1819.855	1484.672	18.132	14.010	0.747	127.469
Median	8.240	106.465	1530.39	1254.805	17.5	13.595	1.83	121.965
Maximum	19.63	435	5694.97	4633.62	27.32	18.91	12.46	224.35
Minimum	4.960	0.550	14.420	10.010	13.090	10.650	-15.450	43.880
Std. Dev.	3.543	110.430	1687.261	1379.469	3.715	2.143	5.171	54.936
Skewness	0.984	1.117	0.709	0.695	1.082	0.747	-1.005	0.207
Kurtosis	3.534	3.810	2.513	2.490	3.422	2.794	5.062	1.800
Jarque-Bera	7.272	9.889	3.935	3.832	8.504	3.977	14.514	2.821
Probability	0.026	0.007	0.140	0.147	0.014	0.137	0.001	0.244

Sum	397.11	4713.38	76433.89	62356.23	761.55	588.41	31.36	5353.71
Sum Sq. Dev.	514.6508	499985.3	1.17E+08	78020339	565.8763	188.2457	1096.504	123735.6
Observations	42	42	42	42	42	42	42	42

Source: Author's calculation (2023)

The mean values of DCP, EXCR, EXCRGI, EXCRPI, GI, PI, RGDPGR and TOT are 9.455, 112.223, 1819.855, 1484.672, 18.132, 14.010, 0.747 and 127.469 respectively. The maximum value among the variables is from the interaction of exchange rate with government/public investment. The Jaque-Bera statistics which reveals the normality of the variables showed that term of trade (TOT) private investment (PI), and the interaction of exchange rate and private investment have normal distribution, while domestic credit to private sector (DCP) exchange rate, government expenditure (GI) and real gross domestic product growth rate (RGDPGR) are not normally distributed. The data distributions of the variables are essentially asymmetric either by skewing to the right or to the left. None shows evidence of symmetry in data distribution.

Correlation Analysis

For the avoidance of the evidence of multicollinearity among the variables, it suffices to conduct a correlational test on the variables.

Table 2: Correlation Matrix of the Variables

	DCP	EXCR	EXCRGI	EXCRPI	GI	PI	RGDPGR	TOT
DCP	1							
EXCR	0.612	1						
EXCRGI	0.694	0.984	1.000					
EXCRPI	0.693	0.983	1.000	1.000				
GI	-0.124	-0.537	-0.494	-0.494	1.000			
PI	0.112	-0.380	-0.297	-0.295	0.938	1.000		
RGDPGR	0.301	0.286	0.291	0.294	-0.512	-0.418	1.000	
TOT	0.529	0.295	0.384	0.389	0.398	0.609	0.007	1.000

Source: Author's calculation (2023)

The usual benchmark according to Gujarati (2021) is 80% or a coefficient of 0.80. Among the explanatory variables the highest is 0.984 which is the result from the interfacing of exchange rate and government expenditure. Therefore, the model is free from multicollinearity.

Unit root test

The simple time series surrounding a deterministic pattern is typically thought to be stationary or at least stable; however, this is not necessarily true. Nevertheless, pre-testing of the unit roots is not necessary for the ARDL co-integration method. However, the study conduct unit root test to determine the number of unit roots in the series in order to prevent ARDL from crashing in the presence of an embedded stochastic pattern of I (2), which could result in an effort in vain. The study used the Phillips-Peron (PP) and Augmented Dickey-Fuller (ADF) tests to confirm the outcome features of the time series.

Co-integration Test: ARDL Bounds Testing Approach

It is typical for variables in time-series analysis to have mixed stationary qualities, necessitating co-integration test. The estimation method that captures this is therefore taken into consideration. The Autoregressive Distributed Lag (ARDL) and ECM used in this study is consistent with Pesaran et., al (2001) work. This model was chosen because, in addition to being effective, it can also be used to estimate time-series equations with a mixed stationary and non-stationary order of I (1) and I (1) and has the potential to solve endogeneity and simultaneity issues. Drawing conclusions from the dynamic behavior and nature of economic variables is also beneficial. This also is coupled with its ability to capture complex results of the dependent variable lagged and another independent lagged variable (s). By including enough lags, it can reduce serial correlation.

Table 3: Stationarity Test for all variables

Variables	Levels		First Differences		Order of
	Intercept	Intercept and Trend	Intercept	Intercept and Trend	Integration
Augmented Dickey-Fuller Test					
RGDPGR	-3.890*	-3.573**			I (0)
TOT	-1.647	-2.576	-5.546*	-5.592*	I (1)
PI	-3.596**	-3.170			I (0)
GI	-1.350	-2.692	-9.002*	-8.885*	I (1)
DCP	-2.354	-3.937	-5.551*	-5.442*	I (1)
EXCR	1.001	-1.457	-5.201*	-5.495*	I (1)
EXCR*PI	-0.002	-1.731	-5.530*	-5.595*	I (1)
EXCR*GI	-1.765	-3.764**			
Phillips-Peron Test					
RGDPGR	-4.024*	-3.484***			I (0)
TOT	-3.146**	-3.216*	-5.529*	-5.591*	I (1)
PI	-4.085*	-3.470***			I (0)
GI	-2.177	-2.713	-9.002*	-8.885*	I (1)
DCP	-1.741	-2.015	-5.490*	-5.442*	I (1)
EXCR	1.250	-1.595	-5.189*	-5.487*	I (1)

EXCR*PI	0.014	-2.019	-5.528*	-5.591*	I (1)
EXCR*GI	-2.962**	-3.885**			I (0)

Source: Author's calculation (2023)
Note: ***statistically stationary at 1%, **statistically stationary at 5% and * statistically significant at 10%

From equation (2), we first test the null hypothesis of no cointegration. H_0: $\Omega_1 = \Omega_2 = \Omega_3 = \Omega_4 = \Omega_5 = \Omega_6 = \Omega_7 = \Omega_8 = 0$ against the alternative using the F-test with upper and lower critical values that are calculated automatically and reported after the ARDL regression estimates. To this end, the order of the lag distribution function should be selected using one of the standard information criteria such as Akaike Information Criterion (AIC) and Schwartz Bayesian Criterion (SBC).

Table 4: Result of Bound Test Approach to Cointegration

Level of Significance	Critical values		Computed F - statistic
$(\alpha\%)$	Lower bound I(0)	Upper bound I(1)	
10	2.03	3.13	3.634841
5	**2.32**	**3.5**	
2.5	2.6	3.84	
1	2.96	4.26	

Source: Author's calculation (2023)

The Error Correction Models (ECM)

One of the most favoured techniques for estimating a dynamic equation at the variable level is to transform the model into an error correction model (ECM). This is demonstrated to give information on the model's short-run and long rub characteristics, with imbalance serving as a strategy for long-run model adaptation (Harris & Stollis, 2003). The error correction (EC) representation of the ARDL model can be written as:

$$\Delta RGDPGR_t = \alpha_0 + \sum_{i=1}^{a}\alpha_{1i}\Delta RGDPGR_{t-1} + \sum_{i=0}^{b}\alpha_{2i}\Delta TOT_{t-1} + \sum_{i=0}^{c}\alpha_{3i}\Delta PI_{3i} + \sum_{i=0}^{d}\alpha_{4i}\Delta GI_{4I} +$$
$$\sum_{i=0}^{e}\alpha_{5i}\Delta DCP_{t-1} + \sum_{i=0}^{f}\alpha_{6i}\Delta EXCR_{t-1} + \sum_{i=0}^{g}\alpha_{7i}\Delta(EXCR*PI)_{t-1} + \sum_{i=0}^{h}\alpha_{8i}\Delta(EXCR*GI)_{t-1} +$$
$$+\Psi ECM_{t-1} \quad \text{.......(4)}$$

Where Ψ is the speed of adjustment and ECM_{t-1} is the error correction term lagged by one time period. The existence of an error correction term among a number of cointegrated variables indicates that changes in the dependent variable depend on both the degree of disequilibrium in the cointegration relationship (represented by the ECM) and the changes in the other explanatory variables. This means that any departure from the long-run equilibrium will have an impact on how the dependent variable changes, forcing a shift in that direction (Faras & Ghali, 2009).

Table 4: Long and Short Run Dynamics Estimated Results for the Selected ARDL (1, 0, 0, 1, 0, 1, 0, and 0)

Regressand: RGDPGR

Panel A: Long Run Coefficients

Variables	Coefficient	Std. Error	T-Statistic	Prob.
DCP	-0.56069	0.42299	-1.3255	0.1961
EXCR	-0.05686	0.12643	-0.4498	0.6565
EXCRGI	0.00021	0.00220	0.0974	0.9232
EXCRPI	0.00191	0.00851	0.2248	0.8239
GI	-0.27889	0.09030	-3.0885	0.0046
PI	0.47031	0.78261	0.6009	0.5529
TOT	0.00451	0.02199	0.2051	0.8391
C	9.83485	11.84342	0.8304	0.4136

Panel B: Goodness-of-fit Measures

R^2	0.65705
Adjusted R^2	0.52514
F-statistic	4.98123
Prob(F-statistic)	0.00047
Durbin-Watson stat	2.32039

Panel C: Diagnostic Statistical Checks

	Test Statistic	Probability
Breusch- Godfrey serial correlation LM test	3.07463	0.2150
Breusch-Pagan-Godfrey test for heteroskedasticity	7.60255	0.6676
Jacque-Bera normality test	3.34595	0.1877
ARCH test for heteroskedasticity	0.30580	0.5803
Ramsey RESET specification test	0.71639	0.4054

Panel D: Short run Coefficients

Regressand: DGDPGR

Variable	Coefficient	Std. Error	T-Statistic	Prob.
D(DCP)	-0.385333	0.29195	-1.319859	0.1980
D(EXCR)	-0.03908	0.088937	-0.439412	0.6639
D(EXCRGI)	-0.002315	0.001896	-1.221353	0.2325
D(EXCRPI)	0.001314	0.005908	0.222383	0.8257
D(GI)	-0.191663	0.080461	-2.38207	0.0245
D(PI)	0.323216	0.523519	0.617392	0.5421
D(TOT)	0.003099	0.015017	0.206388	0.8380
CointEq(-1)	-0.687248	0.148093	-4.640638	0.0001

Cointeq = RGDPGR - (-0.5607*DCP -0.0569*EXCR + 0.0002*EXCRGI +
0.0019*EXCRPI -0.2789*GI + 0.4703*PI + 0.0045*TOT + 9.8349)

Source: Author's calculation (2023)

4.1 Discussion of Results

Unit Root testing

The null hypothesis for the test (both ADF and PP) shows that the data series under consideration has unit root while the alternative hypothesis claims that the series is stationary. As can be seen from Table 1, RGDPGR, PI and EXCR*GI are stationary at levels, while the other variables TOT, GI, DCP, EXCR and EXCR*PI became stationary after the first differencing both under ADF and PP options. This depicts that the series have a combination of I (0) and I (1) which makes ARDL appropriate for estimation.

Co-integration test and estimation of long-run relationship

In estimating the long-run relationship, a two-step method is used: an initial analysis of the nature of a long-run relationship between the variables in equation (2), which is accompanied by an approximation of the short-run and long-run parameters. The boundary test method was used to determine the existence of a long-term relationship between the variables of interest by conducting an F-test for the coefficients of the lagged-level variables of the model. In addition, Pesaran and Shin (1995, 1998) suggested two critical values to evaluate the relationship (lower and upper bound) due to the limitations of the traditional Wald-test F-statistic. The computed F-test is then compared with the critical values provided by Pesaran and Shin (1995, 1998) for the hypothesis test. Therefore, if the calculated F-statistic is less than the lower bound value, the null is not rejected. On the contrary, the existence of a long-term relationship between the variables is suggested if the calculated F-statistics exceed the upper limit value. Finally, there is an inconclusive long-run relation between the variables if the calculated F- statistics are between the lower bound and the upper bound.

In Table 4, the F-statistics value of 3.634841 is above the upper and the lower bound limit at 5% level of significance depicting the existence of a long-run relationship or integration among the variables. Table 4 presented the estimated long run dynamics along with the diagnostic tests. The result reveals that public investment (GI) has a negative and statistically significant impact on economic growth (RGDPGR) at 1 per cent level. The short run dynamics also revealed a negative and statistically significant impact of public investment on economic growth. The error term (CointEq (-1) (speed of adjustment) reveal the expected negative coefficient at a significant level at 1%. This suggests that the divergence from short run to long run is corrected by 68.72 per cent every year.

Exchange rate interaction with public investment has no significant impact on economic growth both in the long and short runs. There is also no significant impact of exchange rate interaction with private investment on economic growth. In addition, no significant impact of private investment is noticed on economic growth both in the long and short runs.

Because ARDL models are estimated by ordinary least squares, it has all estimations and measures available for equations items predictable by ordinary least squares. Panel B of table 4 show the R-squared, Adjusted R-squared, The F-statistics and the Durbin-Watson statistics for the selected model. The explanatory capacity (R^2) of the model is 0.657048. This means that all exogenous variables cause 65.71 per cent changes in the endogenous variable. And that after adjusting for degree of freedom, the adjusted R- squared becomes 0.525143. In essence 52.51 per cent changes now in endogenous variables are attributed to the endogenous variable, while holding other factors constant. The F-statistics measures the joint significance of all exogenous variables on the endogenous variable in order to ensure that there is overall significance of exogenous variables to explain endogenous variable. The F- statistics value is 4.981230 with a corresponding p-value of 0.000469. This shows that the model is good for predictions, The Durbin-Watson value above 2 shows that the model is free from autocorrelation.

The model also passes all the other diagnostic tests. The normality test, serial correlation, heteroskedasticity (Breusch-Pagan-Godfrey and ARCH) tests and the RESET specification test are all favorable. The stability of the regression coefficients is tested using the cumulative sum (CUSUM) and the cumulative of squares (CUSUMSQ) of the recursive residual test for structural stability (Brown et al, 1975). The plots are given in the appendix II.

5.0 Conclusion and Policy Implications

This study investigated the impact of exchange rate on the linkage that exists between Public- Private Investments and Economic growth in Nigeria. Considering the fact that developing countries import a larger proportion of materials needed for turning things around economically, the need to examine the impact of exchange rate movements on this nexus need empirical investigation. Data for the variables were sourced from the Central Bank of Nigeria Statistical Bulletin, 2020. The result showed no significant impact of exchange rate fluctuations on nexus between public-private investments on economic growth for period 1980 – 2021. However, the public investment impacted

economic growth negatively both in the long and short runs. This signifies that the level of public investment has not been enough to have a positive impact of economic growth of Nigeria for the study period, rather affects it negatively. The Federal Government of Nigeria is thereby advised to increase the investment necessary to cause positive economic growth.

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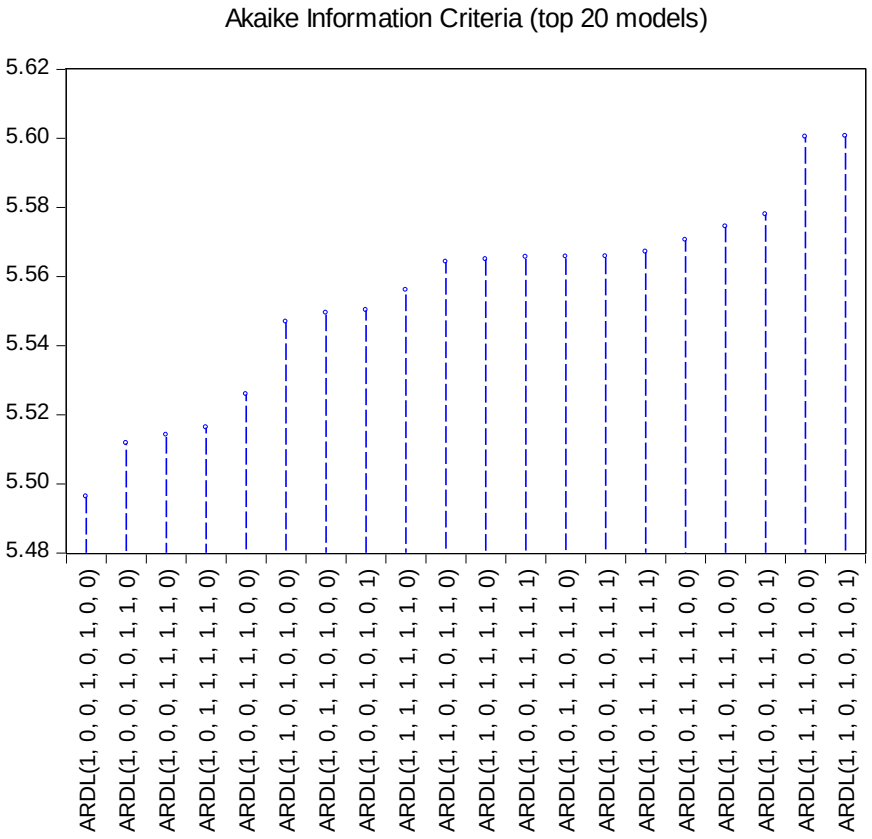
Appendix 1: Model Summary



Appendix II: Plots of CUSUM and CUSUM Square