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Impact of Exchange Rate on Military Capital Expenditure in Nigeria: 1980-2021

[1]Yakwal Manshak Lawson & [2]Aiyedogbon John
[1&2]Department of Economics,
Bingham University Karu, Nasarawa State

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Abstract

The paper examined the effect of exchange rate on military capital expenditures in Nigeria. The aim was to find out if military capital expenditure is affected by exchange rate in Nigeria; and whether there exists a two-way relationship between exchange rate and military capital expenditure in Nigeria. Ex-post Facto design was adopted for the study. Data were sourced from CBN statistical bulletin, the World Bank and Federal Ministry of Defence spanning between 1986 and 2021. The data were analyzed using Toda Yamamoto non-causality test and Auto-Regressive Distributed Lag (ARDL). Military capital expenditure was used as dependent variable, exchange rate as independent variable while inflation rate was treated as a control variable. Augmented Dicker Fuller (ADF) Unit Root Test and ARDL bound test for co-integration test were the formal pre-tests adopted while diagnostic tests employed in the study were Breausch-Godfrey serial correlation LM test, Breausch-Pagan-Godfrey Heteroskedasticity test and stability test. The study found a uni-directional relationship between military capital expenditure and exchange rate and also between military capital expenditure and inflation rate in Nigeria. The study concluded that exchange rate has significant effect on military capital expenditure but military capital expenditure does not have significant effect on exchange rate in Nigeria. The study recommended that the Nigerian military should ensure it receives commensurate compensation on its personnel human costs on foreign missions from the destination countries and also encourage remittances by personnel on foreign mission. This has the potential to improve Nigeria's exchange rate. Also, the Nigerian Ministry of Defence (MoD) should establish a military capital innovation company for research and development of military hardware and to train personnel on manufacturing that capital equipment in the country instead of always relying on imports from advanced countries. This will encourage local consumption and generally reduce pressure on the exchange rate.

Keywords: *Military Expenditure, Military Capital Expenditure, Exchange Rate*

Corresponding Author: Yakwal Manshak Lawson

Background to the Study

All over the world, attention of economists has been shifting towards researches on military expenditure. The study of defence economics involves researching defence problems from various economic fields which involves analysis of the interdependence between defence and the national economy through various routes. The reason behind this might not be unconnected to the fact the expenditure on the military usually constitutes the largest chunk of total government expenditure in annual budgets of countries. In the developed countries expenditure on military often vary between 20% to 25% of the total annual budgeted government expenditure while in the developing countries on the average, it ranges between 10% and 20% of the annual budget expenditure (UNICEF, 2021). In Nigeria, the percentage of military expenditure in the government budget rose from 12% in 2010 to about 16% in 2014, the figure jumped to 18% in 2017 at the heat of insurgence attack on the country. However, military expenditure to the GDP of Nigeria dipped to about 0.37% (UNICEF, 2021). The figure rose slightly to 0.46% in 2019 and further to 0.63% and 0.67% in 2020 and 2021, respectively. In 2022, the percentage of military expenditure in the government budget stood at 0.69% (The World Bank, 2022).

These statistics underscore the importance of military expenditure across the globe and the situation is the same for Nigeria. The rising trend of military expenditure is becoming epidemic as it has spread across various economic blocs across the globe. Defence and internal security spending are important in public budgets of all countries because defence sector is a major user of scarce resources. Although, there have been agitations for reduction in defence spending, most developed and developing countries in the last decade have high defence spending, implying the sacrifice of other sectoral spending.

According to Otto and Ukpere (2012), the Nigerian society is getting more and more insecure, more people are getting into crimes and they are getting more ruthless, desperate and sophisticated. The Nigeria of today, especially since the advent of the present democratic dispensation, new forms of violent crimes have become common; these include kidnapping for ransom, pipeline vandalism, Boko Haram attacks, rape, political violence, banditry and more, which have affected the Nigerian economy adversely (Joseph, 2011). To cope with these conflicts, defence problems have been considered from a new point of view that is capable of changing security measures. Such security measures entail more military expenditure and the impact of such fiscal policy measure on Exchange Rate. Besides, the deep economic crisis that has engulfed the Nigerian economy since 1981 led to the adoption of Structural Adjustment Program (SAP) aimed at, among other things, stable macroeconomic variables.

This study focuses on the impact of exchange rate on military capital expenditure in Nigeria. The Nigerian capital military expenditure is one of the most resilient spending such that any downward trend in such spending results to low performance in the economy. The exchange rate trend, coupled with the different approaches to a stable exchange rate regime in Nigeria has been a major challenge for policy makers in the defence sector. Over the past decade and a half, a substantial volume of empirical research has been directed towards identifying the elements of public expenditure that bear significant association with exchange rate. Nigeria

has passed through different exchange rate regimes in order to find a realistic and dominant exchange rate for price stability but without remarkable success. Exchange rate policy in Nigeria has undergone a good number of changes. It has developed from a fixed parity in 1960 when it was solely tied with the British Pound Sterling. By 1967, following the devaluation of the Pound Sterling, the US dollar was included in the parity exchange. In 1972, the parity exchange with the British Pound was suspended as a result of the emergence of a stronger US dollar. In 1973, Nigeria reverted to a fixed parity with the British Pound following the devaluation of the US dollar. In 1974, in order to minimize the effect of devaluation of a single individual currency,

Nigerian currency was tired to both the pound and dollar. In 1978, the naira was pegged to a basket of 12 currencies comprising Nigeria's major trading partners. However, the 1978 policy was jettisoned in 1985 in favor of quoting the naira against the dollar. Before 1986, the prevailing exchange rate policies encouraged over-valuation of the naira. To solve the problems associated with the over-valuation, the naira was deregulated in September 1986 under the Structural Adjustment Programme Package of General Ibrahim Budamasi Babangida. In 1995 there was a policy reversal of guided deregulation referred to as the Autonomous Foreign Exchange Market (AFEM). In 1999 was the reintroduction of the interbank foreign exchange market (IFEM).

Quite a number of other policies were introduced by the CBN under the regime of Obasanjo in 1999, under Goodluck Jonathan, the fixed and parallel policy were implemented and the devaluation of the naira in 2020. With all the policies implemented, the hasn't been a solution to having a stable currency in Nigeria. Again, Nigeria is an importer of Military Hardware and Software such as Fighter Jets, Intel, and Arms etc which are all domiciled in dollars. The dollarization of defense expenditure puts pressure on naira and also seems to have far reaching implications on the exchange rate, inflation, price incentives, fiscal viability, money supply, interest rate and competitiveness of exports in Nigeria.

High inflation, interest rate differentials, depletion of foreign reserves, structural deficiency in the economy are among the factors responsible for military expenditure in Nigeria. Made-in-Nigeria goods have high prices due to high costs of imported raw materials, in turn caused by high exchange rate volatility, infrastructure problems and inadequate incentives. Other factors working against the strength of the naira at the foreign exchange market include corruption and expansionary fiscal operations by federal and state governments, reckless importation, unnecessary and avoidable foreign trips by political office holders, external debt and interest payment problems are also traced to mismanagement of exchange rate. The objective of this paper is to ascertain the causal effect between military expenditure and exchange rate nexus in Nigeria for the period 1980 – 2021. The paper seeks to ascertain the relationship between military expenditure and exchange rate in Nigeria. Again, the paper aims to determining both the short-run dynamics and the long-run equilibrium relationship existing between exchange rate and the explanatory variables.

The rest of the paper is structured as follows; The next is section two which explains the conceptual framework, as well as the review of empirical findings and theoretical basis for public expenditure and exchange rate nexus. Section three describes the methodology of this paper including data issues and preliminary analyses. Section four presents and discusses the regression results including robustness tests; while section five concludes the paper with policy recommendations.

Literature Review

Conceptual Review

Nurudeen and Wafure (2018) defined government expenditure as expenses incurred by public authorities at the central, state and local government levels. The definition implies all expenses incurred by the federal, state and local governments. Also, they went further by dividing government expenditure in to two namely, capital expenditure and recurrent expenditure. Capital expenditure in the investment made in acquiring things or structures that are permanent. These include money spent by government on building schools, roads, houses, bridges, dams and others.

There are three basic definitions of military expenditure serving as standards for the different international institutions that publish data on military expenditure: that of the North Atlantic Treaty Organization (NATO), the United Nations Organization and the International Monetary Fund (IMF). Only the first two are discussed here. According to NATO, established in 1950, military expenditure comprises; "all current and capital expenditures on the armed forces, in the running of defence departments and other government agencies engaged in defence projects as well as space projects; the cost of paramilitary forces and the police when judged to be trained and equipped for military operations; military R & D, tests and evaluation costs, and costs of retirement pensions of service personnel, including pensions of civilian employees. Military aid is included in the expenditures of the donor countries. Excluded are items of civil defence, interest on war debts and veterans' payments" (NATO, 2010).

The UN definition is based on Stockholm International Peace Research Institute (SIPRI) stipulation. In the view of SIPRI (2010), defence expenditures include all current and capital expenditures on the armed forces, including peace keeping forces; defence ministries and other governmental agencies engaged in defence projects; paramilitary forces when judged to be trained, equipped and available for military operations, and military space activities. Such expenditures should include: personnel–all expenditures on current personnel, military and civil retirements, pensions of military personnel and social services for personnel and their families; operations and maintenance; procurement; military research and development; military construction; and military aid (in the military expenditures of the donor country). Excluded military related expenditures are: civil defence; current expenditure for previous military activities such as veteran benefits, demobilization, and conversion of arm production facilities and destruction of weapon (www.sipri.org).

Conceptually, exchange rate is the value by which two currencies are traded for one another. In other words, it is the rate or value at which one currency can purchase another currency.

For example, as at November 8, 2022, the US dollar may be able to purchase 880 naira on the foreign exchange market. In this case, 1 US dollar is worth 880 naira. The exchange rate is then calculated using the currency purchased, divided by the currency sold. The exchange rate is important because it identifies the value between two or more nations' goods and services. It paves the way for international trade by sending a signal to the market the valuation of each good. For example, without an exchange rate, the US would not know how much $1 is worth to someone in Nigeria nor would the nation know how many goods or services it would be able to buy.

Empirical Review

A plethora of studies have been conducted that relate to the effect of public expenditures on exchange rate in developed and developing economies. Bajo-Rubio (2020) conducted a study on public expenditure and exchange rate in Spain using vector-auto-regression found that public expenditure has significant effect on exchange rate. While a reduction in public investment causes appreciation of export price-based and CPI-based exchange rates, a reduction in public consumption leads to depreciation of the CPI-based real exchange rate, but not of export-based exchange rates. The study was conducted on public expenditures generally while the preset study focuses on military expenditures in Nigeria.

Nuru (2020) examined the effects of public expenditure innovations on the level of the real exchange rate for the South African economy. Using ARDL method, the study found that the exchange rate appreciates in response to innovations, though the effect differs based on the type of fiscal expenditure innovation. While the study was conducted on public expenditure innovations, the preset study focuses on military expenditures in Nigeria. Similarly, Morina (2020) investigated the effect of real exchange rate instability with an observation that low level of exchange rate volatility is required for growth. The study, which employed the fixed effect model of analysis, further supported trade openness and fixed capital formation as other variables that enhance steady economic growth within the Central and Eastern European Countries.

In the same vein, Miyamoto (2019) using exogenous military expenditure panel data of 125 countries, particularly the fixed effect model for analysis. Findings showed that an increase in government spending causes real exchange rate to appreciate and increase consumption significantly, it causes real exchange rate to depreciate and decrease consumption advance countries. Born (2019) investigated public policy and fixed exchange rate using quarterly fixed data of 38 countries. Findings showed that the responses of exchange rates to positive and negative discretionary public expenditure changes are symmetric, and found that expansionary public expenditure appreciates the real exchange rate while contractionary public expenditure depreciates it.

Oyakhilome (2017) in his study based on a panel VAR model analysis revealed that public expenditure is associated with real exchange rate appreciation in countries of sub-Saharan Africa (SSA). The study examined the separate impacts of public consumption, public investment, and transfer payments on the real exchange rate and showed that public

consumption and transfer payments lead to exchange rate appreciation, while public investment causes real exchange rate depreciation in SSA.

Theoretical Framework

The paper adopted the theory of Wagner's Law of Increasing State Activities, German political economist (1835-1917) propounded an empirical law to analyze and explain the trend in the growth of public expenditure. Wagner argued that a functional, cause and effect relationship exist between the growth of an industrializing economy and the relative growth of its public sector. According to Wagner, relative growth of the government sector is an inherent characteristic of industrializing economies. Wagner hypothesized a functional relationship between industrialization and the relative importance of public sector activity. He then set out to test his hypothesis by examining the industrialization process in various European countries and Japan. His observations led to what is now called as Wagner's Law of Increasing State Activity. According to him, there are inherent tendencies for the activities of different layers of a government (such as center and state) to increase both intensively and extensively. According to Wagner's law, the expenditure of public authorizes has a continuous increasing trend due to three reasons, they are:

Expansion of Traditional Functions: Traditional functions mainly include defence, administration of justice, maintenance of law and order and provision of social overheads. The coverage and variety of such functions has gradually increased. Defence expenditure has expanded rapidly because of a change in military arts and sciences. In modern times military activities has become sophisticated. From simple aggression, the modern warfare shifted to prevention of attack and use of sophisticated weapons. Defence outlays on men, materials and maintenance have been on a rising trend in modern times. Similar is the case with expenditure on internal protection and administration. Increasing areas of administration and spread of government machinery with expertise have become more and more expensive.

Coverage of New Functions: Secondly, the activities of the state were increasing in their coverage. Traditionally the state activities were limited to only defence, justice, law and order, maintenance of the states over heads etc. But with the growing awareness of its responsibilities to the society, the governments started expanding its activities in the field of various welfare measures to enrich the cultural life of the society. Along with this new welfare programmes were designed to provide social security to the people. This required increasing government expenditure on education, public health, low-cost housing, subsidized provision of food, agricultural inputs, old age pension, sickness benefit etc.

Expanding Sphere of Public Goods: Almost all modern democratic governments have increasingly recognized the need to provide and expand the sphere of public goods. The need and necessity to provide social and merit goods through budgetary allocation was increasingly recognized by the modern state. The state was trying to shift the composition of national product more in favour of public goods. As a result, state activities expanded to areas like irrigation and flood control projects, construction and maintenance of public parks, provision of education and health care facilities, creation of economic overhead capital etc., Provision

of these public goods and merit goods means heavy investment in public enterprises.

Wagner's Law was used as theoretical basis of study because it provides the rationale for increasing military capital expenditures in Nigeria. Security and the protection of the territorial integrity of a nation is one of the roles of a government of every state as captured in the law which the military is mandated to provide, calls for high allocation of revenue to the military which translates to capital and recurrent expenditures that are inherently bound to rise.

Methodology

This section presents the methodology adopted for data collection and analysis. The study adopts ex-*post facto* research design to extract results from the existing data on military capital expenditures (dependent variable) exchange rate (independent variable) and inflation (control variable) within the span of 1980-2021. Time series data sources were Central Bank of Nigeria statistical bulletins, the World Bank and the Federal Ministry of Defence. The study used Autoregressive Distributed Lag Model (ARDL) and Toda Yamamoto non-causality test for the analysis of the causal effect of exchange rate on military capital expenditures in Nigeria. Formal pre-test used were Augmented Dickey Fuller test for Unit root test and ARDL bound test for co-integration test while diagnostic tests employed in the study were Breausch-Godfrey serial correlation LM test, Breausch-Pagan-Godfrey Heteroskedasticity test and stability test.

Model Specification

This study seeks to examine causality effect of exchange rate on military capital expenditure in Nigeria. Specifically, to establish the mathematical model describing the relationship between exchange rate and military expenditure, the study used real exchange rate as its explanatory variables and inflation rate as the control variable while military capital expenditure was the dependent variable. This was achieved by juxtaposing the Mint Parity Theory of exchange rate and Wagner's Law of Increasing State Activity, which suggests that military capital expenditure depends on exchange rate**.** Therefore, the model for the study becomes.

$$MCE = f(EXR) \quad (1)$$

Where:

MCE = Military Capital Expenditures in Naira; and
EXR = the exchange rate.

While controlling for the effect of inflation on the relationship between exchange rate and military capital expenditure in Nigeria, the model becomes:

$$MCE = f(EXR, INF) \quad (2)$$

Specifying the model in econometric from, model (2) becomes as follows:

$$MCE = \beta_0 + \beta_1 EXR + \beta 1 INF + U \quad (3)$$

The lagged form of Model 3 is specified in Model 4:

$$MCE_{t-1} = \beta_{0t} + \beta_1 EXR_{t-1} + \beta 1 INF_{t-1} + U_t \quad (4)$$

Where $_{t-1}$ are lagged values

The model was log-transformed to obtained their elasticities and achieve uniform measurement of study variables as shown in Model 5

$$MCE_{t-1} = \beta_{0t} + \beta_1 EXR_{t-1} + \beta_2 INF_{t-1} + U_t \quad (5)$$

The Co-integrating regression form of the restricted ARDL model from equation 6 is specified as:

$$\Delta MCE_t = \sum_{t=1}^{p-1} \gamma_i^* \Delta MCE_{t-1} + \sum_{j=1}^{q-1} \Delta EXR_j t - 1\vartheta_j i^* - MCE_{t-1} - \psi - \sum_{j-1}^{k} EXR_j t + \sum_{j=1}^{q-1} \Delta INFL_j t \quad (6)$$

$$-1\vartheta_j i^* + \mu_t$$

The bound test for the existence of long run relationships is then simply a test of

$$H_0: \delta_1 = \delta_2 = \ldots\ldots\ldots\ldots \delta_{.} = 0 \quad (7)$$

The Co-efficient estimates used in the test could be obtained from a regression using equation 7 or it can be estimated directly from a regression equation 6. The decision rule is that, if the computed F-Statistic falls above the upper bound critical value of F – Statistic falls above the upper bound critical value of F – Tabulated developed by Pesaran, the null hypothesis of no Co-integration is rejected which implies that long run relationship exists among the variables of interest. On contrary, if the F- Statistic falls below the lower bound, then the null hypothesis of no Co-integration is rejected which implies that long run relationship exists among the variables of interest. On contrary, if it falls below the lower bound, then the null hypothesis of no Co-integration cannot be rejected. Finally, if it lies between these two bounds, the result will be inconclusive.

The conditional (unrestricted) ARDL steady state of the model is of the form:

$$\Delta MCE_t = \alpha_0 + \alpha_1^i MCE_{t-1} + \alpha_2^i EXR_{t-j} + \alpha_3^i INFL_{t-k} + \sum_{i=1}^{n} \alpha_6 \Delta POV_{t-1} + \sum_{j=1}^{m} \alpha_7 \Delta EXR_{t-1} + \sum_{k=1}^{o} \alpha_8 \Delta INFL_{t-1} + \mu_t \quad (8)$$

The logarithm form of the ARDL is specified as follows:

$$\Delta LogMCE_t = \alpha_0 + \alpha_1^i EXR_{t-i} + \alpha_2^i INTL_{t-j} + \sum_{i=1}^{n} \alpha_6 \Delta LogMCE_{t-1} + \sum_{i=1}^{m} \alpha_7 \Delta EXR_{t-i} + \sum_{k=1}^{o} \alpha_8 \Delta INFL_{t-1} + \mu_t \quad (9)$$

Where:

Δ = First Difference Operator

α_0 = is constant parameter, while

$\alpha_1 - \alpha_9$ are parameter coefficient of the variables

μ_t = the Error Term

The hypothesis in investigating the presence of a long run relationship among the variables in equations 9 and 10 requires a Wald test in which the joint significance of the Co-efficient for lagged variables is tested.

The study will perform a joint significance test, where the null hypothesis

$$H_0 = \alpha_1 = \alpha_2 = 0 \quad (10)$$

$$H_1 \neq \beta_1 \neq \beta_2 \neq 0 \quad (11)$$

The acceptance or rejection of the hypothesis is based on comparison between the calculated F-statistic and the F-statistic tabulated by Pesaram, Shin and Smith (2001). The tabulated F-statistic has both upper and lower bounds critical values. The decision rule is that, if the calculated F-statistic is higher than the upper bounds, the null hypothesis is rejected and the alternative hypothesis is accepted that there is long run relationship between the variables. But if the calculated F-statistic is lower than the lower bound critical value, the null hypothesis cannot be rejected and the alternative hypothesis cannot be accepted. Meaning there is no long run relationship between the variables. However, the test is inconclusive if the calculated F-statistic lies between the lower and upper bound critical values.

After establishing the existing of a long run relationship between the variables, the study will proceed to examine the long-run effect and the short run dynamics using the unrestricted error correction model (ECM) approach. Using the ECM proposed by Inder (1993) with some modification, which is in line with this study, the model is specified as follows:

$$\Delta MCE_t = \alpha_0 + \sum_{i=1}^{m} \alpha_1^i \Delta MCE_{t-1} + \sum_{j=1}^{n} \alpha_2^i \Delta EXR_{t-1} + \delta ECT_{t-1} + \mu_t \quad (12)$$

Where δ is the speed of adjustment parameter or coefficient, ECT_{t-1} (which is the lagged Error Correction Term) is the residual obtained from the long run estimation. The coefficient (δ) is expected to be less than one, negative and statistically significant. The negative sign of the ECT_{t-1} term indicates long run convergence of the model to equilibrium as well as explaining the proportion and the time it takes for the disequilibrium to be corrected or restored back to equilibrium i.e. the disturbed system to return to equilibrium.

The magnitude of the Co-efficient measures the speed of adjustment. The ECT_{t-1} further capture the output evolution process by the agent adjusts for prediction errors made in the last period.

The null hypothesis is as follows:

$$H_0 = \beta_1 = \beta_2 = 0 \quad (13)$$

$$H_0 = \lambda_1 = \lambda_2 = 0 \quad (14)$$

$\beta_1 - \beta_2$ were the long run multipliers (parameters), β_0 is the intercept (the drift component); λ, were the short-run parameters.

A Priori Expectation

The a priori expectation tells the pre-determined signs based on theory, between the dependent and independent variables. The *a priori* expectations for the coefficients in this study are symbolized as illustrated in Table 1.

Table 1: Study's a-priori Expectations

Variables	Dependent	Independent	*A-priori* expectation	Signs
Specified Model	**MCE**	**EXR**	$\alpha_1 > 0$	+
		INFL	$\alpha_1 > 0$	+

Source: Author's Computations, 2022.

Results and Discussion

This section comprises descriptive statistics, Toda Yamamoto and Auto-regressive Distributed Lags (ARDL) results.

Descriptive Statistics

Table 2: Descriptive Statistics of Study Variables

Variable	Mean	Std. Dev.	Skewness	Kurtosis	JarqueBera	Probability	Obs
MCE	104146.5	163519.4	2.046056	6.211444	47.35281	0.000000	42
EXR	105.7359	109.7651	1.000412	3.195512	7.072662	0.129120	42
INF	53426.44	79294.59	1.402684	4.040038	15.66559	0.073397	42

Source: Extract from Results of E-views 9.

Table 2 shows the summary statistics on the variables used in the study for test of normality properties of residuals in the data set. The standard value of Skewness of a symmetric distribution, such as normal distribution is zero. The Skewness values were above zero but are reasonably low (except MCE) which suggests that they are not Skewness abnormal and suggests that the series exhibit the characteristics of a normal distribution. The Kurtosis of a normal distribution is 3. The Kurtosis distribution measures the peakness of a distribution that is usually assumed to be normal. As shown in Table 2, the series values were close to 3 (except MCE). The divergent of EXR from normally distributed values could be due to the inefficient process of documenting recurrent defence expenditures. Results produced on EXR could therefore, be spurious. Nevertheless, the results can be considered as reliable since the series do not exhibit characteristic of a distribution with a high peak and flat tails called leptokurtic ($k>3$). They do not also have substantially flat-topped curves and thinner tails called platykurtic ($k<3$), but they have generally exhibited mesokurtosis ($k=3$) suggesting a normal distribution. Jarque – Bera results show that apart from MCE, the rest of the series suggested rejection of the null hypothesis of a normal distribution. It is therefore, clear that the series are subject to distribution that is not different from the normal one.

Causal Relationship between Military Capital Expenditure and Exchange Rate in Nigeria
The causal relationship between military capital expenditure and exchange rate was discussed in this section. The VAR lag order selection and the VAR models were first estimated as pre-requisites for the estimation of Toda Yamamoto causality test.

Table 3: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1239.496	NA	4.27e+25	73.20566	73.43013	73.28221
1	-1151.478	144.9708	1.07e+24	69.49872	70.84551*	69.95801*
2	-1123.001	38.52733*	9.64e+23*	69.29421*	71.76332	70.13624

Source: Extract of Author's Computations from E-views 9.

Table 3 shows that LR, FPE and AIC suggest the selection of a maximum lag length of2 while SC and HQ suggests the selection of a maximum lag length of 1. Since the highest order of integration was 2, when estimating the EXR model, an additional lag of 2 was added to the selected lag of 2, thus, making it 4 lags for the Toda Yamamoto model.

Table 4: Toda Yamamoto Granger Non-Causality Test

Causality	F-Statistic	df.	Prob.	Decision
MCE→EXR	2.80429	2	0.0342	Relationship exists
EXR→ MCE	1.63895	2	0.2087	No relationship exists
MCE→ INFL	0.40956	2	0.6671	No relationship exists
INFL→ MCE	5.93846	2	0.0060	Relationship exists
EXR→ INFL	2.97552	2	0.0641	No relationship exists
INFL→ EXR	3.62932	2	0.0370	Relationship exists

Source: Extract of Author's Computations from E-Views 9.

Results of Toda Yamamoto Granger non-causality test presented in Table 4 reveals that military capital expenditure Granger-causes exchange rate in Nigeria. Thus, the F-Statistic value of causality from MCE to EXR of 2.80429 was significant at 0.05 level (p, 0.0342<0.05). However, the F-Statistic value of causality from EXR to MCE of 1.63895 was not significant at 0.05 level (p, 0.2087>0.05), implying that exchange rate does not Granger-cause military capital expenditures in Nigeria. Thus, there is uni-directional relationship between military capital expenditures and exchange rate in Nigeria. The table indicates that military capital expenditure Granger-causes inflation rate in Nigeria. Thus, the F-Statistic value of causality from MCE to INFL of 0.40956 was not significant at 0.05 level (p, 0.6671>0.05). However, the F-Statistic value of causality from INFL to MCE of 1.63895 was significant at 0.05 level (p, 0.0060<0.05), showing that inflation rate Granger-causes military capital expenditure in Nigeria. This suggests the existence of uni-directional relationship between military capital expenditure and inflation rate in Nigeria.

Toda Yamamoto Post Estimation Tests

The post estimation tests were conducted to examine the presence of serial correlation and heteroskedasticity in the series and whether the data used were stable.

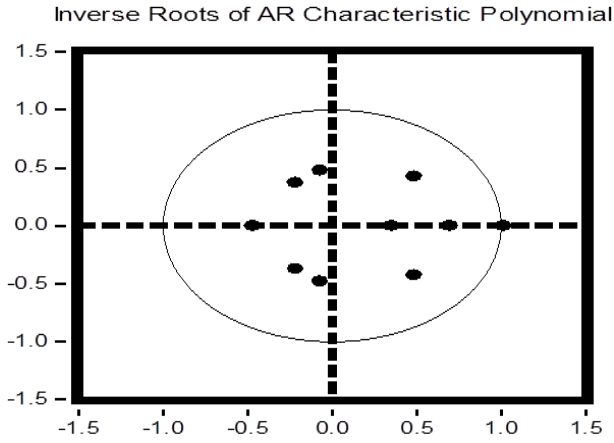
Table 5: Residual Test for Toda Yamamoto Results

Test Statistics	Probability	Decision
Serial Correlation CHSQ =	0.0208	No serial Correlation
Heteroskedasticity CHSQ =	0.06400	

Source: Extract of Author's Computations from E-views 9. (*) means significant at 5%

The residual serial correlation test result presented in Table 5 shows that there is no serial correlation (as the probability values were found to be greater than 0.05). Thus, the null hypothesis of no serial correlation was accepted. The Breausch-Pagan-Godfrey Heteroskedaticity Test results indicate that the residuals are homoscedastic (that is, they have constant variance). Thus, the series are reliable.

Figure 1: Graph of Inverse AR Characteristic Polynomial



Source: Extract of Author's Computations from E-views 9.

The study applied Inverse Roots of AR Characteristic Polynomial test to examine how stable the variables entered the VAR model on the corruption route. Results satisfy the VAR stability condition since all the roots were less than 1 and lie within the unit circle shown in Figure 1. This means the series are stable.

Effect of Exchange Rate on Military Capital Expenditures in Nigeria

Before estimating the effect of military expenditure on exchange rate in Nigeria, the study first conducted stationarity test to examine the nature of integration of the series so as to establish long-run relationship between the series and also determine the short-run dynamics.

Table 6: Summary of Stationarity Test Results

Variables	ADF Statistics	Critical Value	Order of Integration
MCE	-5.862572	-3.526609 at (5%)	I(1)
EXR	-8.700633	-3.526609 at (5%)	I(1)
INFL	4.664533	-3.540328at (5%)	I(0)

Source: Author Computation, 2022 (E-views-9).

Results presented in Table 6 show that most of the series failed to attain stationality at levels, except INFL. Thus, the series have indicated a mixed order of integration. Since the series indicated a mixed order of integration, the appropriate method of estimation was the Autoregressive Distributed Lag (ARDL) method. The study then examines if series were co-integrated in the long-run using ARDL Bound test. ARDL lag length selection and the residual tests are therefore conducted to select the appropriate lags and examine the behaviour of the residuals.

Table 7: ARDL Lag Length Selection for the Dependent Variable

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-313.1250	NA	580188.2	16.10897	16.15163	16.12428
1	-307.7112	10.27237*	462701.3*	15.88262*	15.96793*	15.91323*
2	-307.6549	0.103914	485748.8	15.93102	16.05899	15.97693
3	-307.6078	0.084463	510290.3	15.97989	16.15051	16.04111

Source: Extract from Results of E-views 9.

Table 7 suggests the selection of a maximum lag length of 1 for the ARDL bound testing for co-integration result. The maximum lag of 1 was therefore selected for ARDL bound testing model.

Table 8: ARDL Bound Testing for Co-integration Result

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-Statistic	6.074356	10%	3.17	4.14
K	2	5%	3.79	4.85
		2.5%	4.41	5.52
		1%	5.15	6.36

Source: Extract from Results of E-views 9.

From the result of co-integration test captured in Table 8, it could be seen that the F-statistic value of 6.074356 was greater than the lower [I(0)] and the upper bound [I(1)] critical values of 3.79 and 4.85 respectively at 5% level of significance. It can therefore, be inferred that the values are co-integrated, and as such, there is a long-run equilibrium relationship between military expenditures and exchange rate in Nigeria. In view of the co-integrating relationship between military expenditures and exchange rate in Nigeria, the study proceeds to use the ARDL-ECM to estimate the error correction and long-run models. Henry's (2005) general-to-

specific Modelling Approach was utilized to derive a satisfactory parsimonious result for the foreign aid – capital flight transmission. The result of the reduced short-run model is presented in Table 9

Table 9: Result of ARDL Error Correction

Co-integrating Form				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(EXRT)	-0.000256	0.000304	-0.843252	0.4068
D(INFLT)	-10.560284	20.950849	-0.504050	0.6185
D(@TREND())	2.616457	23.128476	0.113127	0.9108
CointEq(-1)	-0.576088	0.151319	-3.807116	0.0008

Source: Extract of Author's Computations from E-views 9.

Table 9 shows the short-run dynamics of series. The table reveals ECM value of -0.576088 which fulfils all the three ECM conditions of being negative, less than unity and significant at 0.05 per cent. This implies that variables included in the model have the ability of returning to long-runequilibriumafter experiencing short-run oscillations at a speed of adjustment of 57.6088%. This indicates high speed of adjustment to long-run equilibrium. The study therefore examines the long-run estimates of the relationship between foreign aid and capital flight. The result is presented in Table 10.

Table 10: Long-Run Coefficients of EXR ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXRT	-0.000096	0.000136	0.705104	0.4870
INFLT	7.986732	42.351385	-0.188583	0.8519
C	2365.527391	2593.7308	0.912017	0.3701
@TREND	4.541769	40.574352	0.111937	0.9117

Source: Extract of Author's Computations from E-views 9.

MCE = 0.0001*EXRT-7.9867*INFLT + 4.5418

Table 10 shows that a negative log-run relationship exists between EXRT and MCE in Nigeria. This suggests that the military rely on imported capital thereby, encouraging high level of capital expenditure. This expenditure is affected by exchange rate dynamics such that high exchange rate leads to low military capital expenditures while low exchange rate leads to high military capital expenditures. However, this long-run relation is near zero. On the other hand, a positive long-run relationship exists between INFLT and MCE in Nigeria such that an increase in INFL by one percent leads to 7.96\867 percent increase in MCE. This resul is expected since military capital expenditure is imported-dependent and therefore, rarely negatively affected by inflation in Nigeria. Thus, while a negative relationship between INFL and MCE is not likely, the positive trend between the two variables is also likely to occur by chance.

Table 11: Residual Test Results of ARDL Model

Test Statistics	Probability	Decision
Serial Correlation CHSQ (BGS)=	0.9717	No serial Correlation
Heteroskedasticity CHSQ =	0.6870	Residuals are homoscedastic
Linearity Test (Ramsey Reset Test)	0.2885	Model is linear

Source: Extract of Author's Computations from E-views 9.

Table 11 shows no evidence to show that the residuals based on Breausch-Godfrey Serial Correlation LM Test results, are not affected by autocorrelation. The Breausch-Pagan-Godfrey Heteroskedasticity Test results indicate that the residuals are homoscedastic (that is, they have constant variance). Thus, the series are reliable. Based on the result of Ramsey Reset Test, the model is also correctly specified.

Table 12: Wald Test of Hypothesis

Test Statistic	Value	Df	Probability
F-statistic	0.564483	(1, 30)	0.4583
Chi-square	0.564483	1	0.4525

Source: Authors' Computations using E-Views 9

The result of Wald test shows that the value of the F-statistics of 0.564483 was not significant at 0.05 level (p, 0.4583>0.05). The null hypothesis which stated that military expenditure does not have any significant effect on exchange rate in Nigeria was therefore not rejected.

Robustness Test Results

To determine the reliability of the findings, the paper ran a number of post-estimation diagnostic tests. The paper conducted tests for heteroscedasticity, normality, and the serial correlation Lagragian Multiplier test (for higher order autocorrelation). The probability-value (p-value) of each test must be larger than 0.05, or the level of significance of 5%, in order to accept the null hypothesis for any of these diagnostic tests. The residual test results are therefore presented in Table 6:

Table 13: Robustness (Test) Results

Tests		Outcomes	
		Coefficient	Probability
Breusch-Godfrey-Serial-Correlation-Test	F-stat	0.132229	0.7188
Heteroscedasticity-ARCH Test	F-stat	0.138187	0.9943
Normality Test	Jarque-Bera	170.85	0.00000

Source: Author's Computation, 2022 (E-views 9)

The residual serial correlation test result presented in Table 13 shows that there is no serial correlation (as the probability values were found to be greater than 0.05). Thus, the null hypothesis of no serial correlation was accepted. The Heteroskedasticity ARCH Test results indicate that the residuals are homoscedastic (that is, they have constant variance) since the

probability value was greater than 0.05. Thus, the series are reliable. The probability value of JarqueBera Test being less than 0.05 indicates that the data used are normally distributed.

Discussion of Findings

The study found that there is uni-directional relationship between military capital expenditure and exchange rate in Nigeria. While exchange rate responded significantly to military capital expenditure, the response of military capital expenditure to exchange rate was not significant. This finding is consistent with that of Miyamoto (2019) and Ilzetzki (2013) which showed that expansionary public expenditure innovation leads to real exchange rate depreciation in developed countries while it causes real exchange rates to appreciate in developing countries.
Similarly, there was uni-directional relationship between military capital expenditure and inflation rate in Nigeria. While inflation rate had no significant response to military capital expenditure, the response of military capital expenditure to inflation rate was significant. The study found that there was a long-run equilibrium relationship between military capital expenditures and exchange rate in Nigeria. Specifically, a negative log-run relationship existed between exchange rate and military capital expenditures in Nigeria.

On the other hand, a positive long-run relationship exists between inflation rate and military capital expenditures in Nigeria. This suggests that as exchange rate decreases, the military tend to import capital equipment from abroad since they are not manufactured in Nigeria, but when exchange rate increases, the military resorts to use the available funds for recurrent expenditures which are principally for domestic operations. Since exchange rate which are always volatile in Nigeria, usually rally above equilibrium, military capital expenditure does have significant effect on exchange rate in Nigeria.This finding is in concord with the study of Benazic and Kersan-Skabic (2016) which indicated the existence of a stable co-integration relationship between the observed macroeconomic variables and the nominal exchange rate, whereby an increase in majority of the variables led to an exchange rate appreciation.

Conclusion and Recommendations

Exchange rate has significant effect on military capital expenditure but military capital expenditure does not have significant effect on exchange rate in Nigeria. High exchange rates discourage the use of funds for the purchase of capital equipment which are mostly imported from abroad, and use same for recurrent expenditures while low exchange rates encourage the military to spend available funds on capital projects. In view of this conclusion, the following recommendations are made:

i. The Nigerian military should ensure it receive commensurate compensation on its personnel human costs on foreign missions from the destination countries. This has the potential to improve Nigeria's exchange rate.
ii. The Nigerian Ministry of Defence (MoD) should establish a military capital innovation company to train personnel on manufacturing capital equipment in the country instead of always relying in imports from advanced countries. This will improve balance of trade and consequently help to stabilize the country's exchange rate.

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