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ESTIMATING THE SIZE OF CONSTRUCTION INDUSTRY EXPENDITURE FOR ECONOMIC DEVELOPMENT AND SUSTAINABILITY IN NIGERIA: AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) APPROACH

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Abstract

The expansion of annual capital budget over the years without a corresponding increase in the volume and quality of infrastructural development in Nigeria has been attributed to those factors assumed to have great impact on the economic performance of the country. This study examined the effect of selected economic factors on the size of construction sector expenditure in Nigeria using economic data from 1981-2020. It employed econometrics statistics. The result revealed that there was a long-run co-integration among the variables with ARDL bound estimate values of F-stat. (7.40) and t-stat. (-6.56) respectively. These are higher than both the lower and upper bound critical values at 1%, 2.5%, 5% and 10% respectively. The result further revealed that exchange rate, oil prices, population, trade openness, foreign direct investment, unemployment rate, public debt and real GDP were important determinants of the size of construction sector expenditure in Nigeria. It also revealed that construction output, inflation rate, government revenue and taxation had trivial determinants due to issues relating to policy, management and execution of capital budget. The study suggested that government should make and implement apposite policies, and be diligent in allocation and management of public fund to ensure a sustainable economy through infrastructural development.

Keywords: Capital Budget, Construction Sector, Economic Development, Public Expenditure, Wagner's Law

JEL Classification: H54, L74, N67, O18

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1. Introduction

The construction sector's roles in the social, physical and economic development of nations have been documented and empirically verified by the construction, economic and development scholars all over the world (Deravi, 2017; Jiang and Liu, 2015; Oke et al., 2016; Oladinrin et al., 2012; Olatunji et al., 2016). However, the production of construction products in the form of infrastructural development is accompanied by a huge capital outlay (National Bureau of Statistics (NBS), 2014). For example, in the 2020 budget, the Federal Government allocated N3.18 trillion representing 30.67% of the nation's total budget to capital expenditure. In 2019 N2.09 trillion representing 23.49% of the total budget was allocated. In 2018 it was N2.87 trillion representing 31.46% of total budget, while N2.36 trillion representing 31.73% of total budget was allocated to it in 2017. In 2016 and 2015, it was 1.58 trillion and N557 billion respectively (Ahmed, 2019; Owoeye, 2019; Udoma, 2018; 2018b); whereas ₦344 billion and ₦ 280.44 billion were voted for the construction and rehabilitation of roads alone nationwide in 2018 and 2019 respectively (Udoma, 2018a; 2018b). Similarly, there are recurrent expenditures associated with public capital projects, which are those expenditures needed for operation and maintenance of the project to its expected level of use, so as to maintain the capacity of the investment throughout its anticipated lifetime (Hood et al., 2002).

Generally, public expenditure in Nigeria, has rapidly grown, even as a proportion of the GDP in recent years through different government activities (Jibir and Aluthge, 2019). Babatunde (2018) agrees that government has continued to increase spending on infrastructure with a view to achieving economic growth and ease the burden of the citizens. However, the rise in government expenditure has been attributed to those factors believed to have great influence on the economic performance of the country (Jibir and Aluthge, 2019). As a result, there has been a raging theoretical and empirical debate over the determinants of government expenditure across the countries of the world since Wagner's foundational study in 1883 (e.g. Durevall and Henrekson, 2011; Eterovic and Eterovic, 2012; Facchini and Melki, 2013; Gachunga, 2019; Jibir and Aluthge, 2019; Kumar et al., 2012; Magazzino et al., 2015; Maluleke, 2017; Shonchoy, 2010; 2016). According to Aladejare (2019) and Uchenna and Evans (2014), these debates are even very necessary and healthy because those factors determining the government expenditure are needed in the management of fiscal inequalities as well as to encourage stability and sustainability in the economy. Secondly, the huge financial commitment on the capital projects have not yielded the desired results (Edame et al., 2014) thereby, leading to a dysfunctional infrastructural development in Nigeria.

In Nigeria, the growth in government expenditure either in real or as a proportion of GDP has not reflected in the country's developmental indices such as reducing poverty and unemployment rates, increasing physical infrastructure, etc. This has amounted to a waste of scare resources to the disadvantage of Nigerian taxpayers (Babatunde, 2018). More worrisomely, construction sector is a dynamic and volatile industry with increasing uncertainties in local and global construction business environments (Škuflić et al., 2018); especially during economic instability (Okoye et al., 2016). This is against the proposition that suggests that the provision of physical infrastructure which heralds the socio economic development and increasing economic activities of a country, including improving human welfare and poverty reduction is the responsibility of the construction sector (Taye and Dada, 2012). Therefore, understanding the rationale for the rising government expenditure should be of serious concern to the public sector stakeholders because most of the countries of the world have had consistent increase in government expenditures over the years (Ukwueze, 2015).

Since the construction sector output is seen as a gauge for economic growth and development (Babatunde, 2018), this study argues that the construction sector's expenditure should be reflected in the level of socio-economic development of any nation. On this premise, this study further argues that the size of construction sector's expenditure is a function of interaction between many socio-economic activities. Unfortunately, existing studies have not been directed towards gauging the factors determining the size of construction sector's expenditure in Nigeria. According to Paternostro et al. (2005), the composition of public expenditure is a key instrument by which development agencies seek to promote economic development and sustainability. By estimating the size of construction sector expenditure in Nigeria, this study was expected to reveal the socio-economic variables that are capable of promoting or inhibiting the growth and development of Nigeria through the construction sector intervention. The study was also expected to reveal the areas that required immediate and long-term government intervention through adequate and proper capital spending. Thus, this study was aimed at estimating the size of construction sector expenditure for economic development and sustainability in Nigeria.

2. Theoretical Framework

The determinants of government expenditures have been documented in the existing literature (Aigheyisi, 2013). Early economic theorists have espoused different theories explaining the size of government expenditures in relation to economic growth. Although there are a lot of theories explaining the public expenditure of a country, such as The Wagner's Law of Increasing State Activities, The Keynesian Theory, The Peacock and Wiseman's Theory of Expenditure and The Ernest Engel's Theory of Public Expenditure; this study is premised on The Wagner's Law of Increasing State Activities which states that the development of economy over time is accompanied by a rigorous and widespread rise in the government activities and functions which consequently leads to increase in government expenditure. In the literature, there is relative agreement that suggests that Wagner's Law should be construed as estimating an increasing comparative part of government expenditure in the overall economy as per capital real income increases (Jibir and Aluthge, 2019).

There is plethora of empirical studies that gave credence to the application of Wagner's Law both in the developed and developing countries (e.g. Adamu and Hajara, 2015; Awuh, 2018; Facchini, and Melki, 2013; Jalles, 2019; Jiang and Liu, 2015; Jibir and Aluthge, 2019; Kumar et al., 2012; Magazzino et al., 2015; Obeng and Sakyi, 2017; Sagdic et al., 2020; Yun and Yusoff, 2018). However, while these studies suggested that the rate at which a country grows economically and physically is a function of the size of government outlay; other studies such as Balaj and Lani (2017), Durevall and Henrekson (2011) and Pelawaththage (2019) posit that the overall economic growth and development of a country is not always associated with an increase in the size of government expenditure.

In the instant case, Wagner's Law was applied in estimating the size of construction sector expenditure for economic development in Nigeria. The fact that construction sector stimulates socio-economic growth and development (Owoeye, 2019) is enough justification for the choice of this theory. Therefore, there is likelihood of increasing spending for construction projects as the demand for economic and physical development increases (Babatunde, 2018; Pheng, and Hou, 2019).

3. Empirical Review

Empirically, existing literature have expressed divergent views on the determinants of government expenditures that affect economic growth and developments (e.g. Akanbi, 2014; Aladejare, 2019; Aregbeyen and Akpan, 2013; Jibir and Aluthge, 2019; Mogues, 2012; Ukwueze, 2015; Uwakaeme, 2017). However, these studies are limited in context and composition, and do not directly pinpoint the construction industry's scenario. For example, by incorporating some economic variables, Jibir and Aluthge (2019) modified Wagner's law and employed it to predict their influence on the size of government expenditure, using time series data from 1970 to 2017 in Nigeria. The ARDL analysis revealed that GDP, oil revenue, oil price, trade openness, taxation, inflation and population are significant elements of' government expenditure in Nigeria. Likewise, Aladejare (2019) revealed that oil price, oil revenue and price level are the major contributing factors of government expenditure.

Ukwueze (2015) applied an Error Correction Model (ECM) and long-run static equation to estimate the size of government spending in Nigeria. The study showed that the size of income and national income growth rate as well as the private investment significantly determine the size of government expenditure both in the short and long-run. It further revealed that both domestic and external debts only influenced significantly, the size of government expenditure in the short-run. Adama and Ohwofasa (2015) found that oil revenue was the most significant determinant in the funding education expenditure in Nigeria in short and long-run respectively. It also revealed that funding from non-oil revenue was insignificant, whereas impact of external sector on education expenditure was deleterious.

There is no doubt the veracity of these studies on the determinants of public expenditures and their effects on economic development, however, studies focusing on the construction industry are drought and indirect. Generally, there is dearth of information about the construction sector for construction planners and economists. Where it exists, it is usually parsimonious. However, very few studies such as Edame et al. (2014) have partially looked at the construction sector. These studies revealed that the rate of urbanisation, openness, external reserves, government revenue, type of government (administration) and population density, influenced the growth of public expenditure in the short-run. Contrarily, it found that the growth of public infrastructure was not commensurate with the amount of public expenditure as shown by the amount of deterioration in the public utilities.

Foye (2014) examined the macroeconomic factors predicting the public capital expenditure in Nigeria using ECM. The study revealed that real gross domestic product, budget deficit, government debt, trade openness, public debt servicing, private investment, foreign direct investment and previous public capital spending have significant and negative long-run relationship with public capital spending while degree of urbanisation did not have any effect on public capital spending. Another study by Omodero (2020) investigated the factors influencing government capital investments in Nigeria using economic data from 2000-2017. The study found that real GDP and population have insignificant negative impact on the capital investments, while debt servicing has a significant negative influence. It further found out that inflation rate does not have any influence but exchange rate and total expenditure have significant positive influence on the capital expenditure. *On the other hand,* Obeng and Sakyi (2017) found that an increase in population increases the public sector expenditure. An insignificant relationship was established between inflation and growth in public expenditure by Okafor and Eiya (2011), contrary to Olayungbo (2013) who posted a long-run equilibrium relationship between government expenditure and inflation.

Recently, Okoye (2021) investigated the relationship between public investments in the construction sector and economic growth in Nigeria and found that federal government capital expenditure influences economic growth negatively, while recurrent expenditure on construction sector exerted a positive and significant effect on economic growth with a causal effect flowing from construction expenditure to GDP without feedback. Another study by Okoye et al. (2021) found that there were both long-run and short-run dynamic relationships between poverty rate and construction sector variables whereas no long-run equilibrium relationship exist between unemployment rate and construction sector variables in Nigeria.

In spite of the foregoing theoretical and empirical realities, studies concerning the determinants of the size of construction industry expenditure in Nigeria is still sketchy and peripheral. According to Molapo (2017), investment in construction infrastructure is very pertinent in the planning and economic development because of its fundamental role in the economy, mode and capacity of production of any country. Furthermore, development cannot result to a sustainable living if there is no construction infrastructure investment (Fatai et al., 2016). It is against this backdrop that this study estimated the size of the construction industry expenditures by integrating relevant economic variables into the Wagner's model so as to establish a path for economic and developmental sustainability in Nigeria.

4. Methodology

4.1. Theoretical model

As earlier noted, this study was based on the Wagner's basic proposition which stated that an increase in the per capita income would be associated with a corresponding increase in the government expenditure. Mathematically, this is expressed in equation 1:

$$GE = f(Y) \tag{1}$$

where GE = Government Expenditure and Y = Income. As equally noted, Wagner's law has been modified into different functional forms which were applied in the determination of the causes of increase in the government spending both in the developed and developing countries (e.g. Adamu and Hajara, 2015; Awuh, 2018; Jibir and Aluthge, 2019; Obeng and Sakyi, 2017; Sagdic et al., 2020). However, the adjustment of the actual level of government expenditure (*GE*) takes some time in line with the new income level (*Y*). furthermore, based on the assumed adjustment, the estimated Wagner's model becomes the functional form and is presented in Equation (2).

$$GE_t = a + bY_t \tag{2}$$

Meanwhile, other relevant can be incorporated into Equation (2) to estimate the size of government expenditure. In the instance case, Equation (2) was modified by incorporating some socio-economic variables to formulate a theoretical model for the Construction Sector Expenditure. In order to estimate the size of Construction Industry Expenditure, Equation (2) was transformed to Equation (3) by including these relevant variables identified in the literature.

$$\begin{aligned} CEX_t = {} & a + b_1 FGR_t + b_2 TOP_t + b_3 FDI_t + b_4 EXR_t + b_5 TXN_t + b_6 INR_t + b_7 POP_t + b_8 UNR_t + b_9 PDT_t \\ & + b_{10} OLP_t + b_{11} GDP_t + b_{12} CNS_t \end{aligned} \tag{3}$$

where CEX = Construction Industry Expenditure, FGR = Federal Government Revenue, FDI = Foreign Direct Investment, TOP = Trade Openness, EXR = Exchange Rate, TXN = Taxation, INR = Inflation Rate, POP = Population, UNR = Unemployment Rate, PDT = Public Debt, OLP = Annual Average Oil Prices, GDP = Real GDP, and CNS = Construction Output. *a* is the constant parameter of the lagged dependent variable which provides the rate of self-perpetuating adjustment of the total government expenditure. b_1–b_{12} are constant parameters of the independent variables presented in logarithm. The signs and magnitude of these parameters will measure the nature of the effect or impact of this development on the people.

Since these variables were not measured in the same unit, they were transformed into their respective logarithm forms to maintain uniformity in the model estimation. Hence, Equation (3) is transformed to Equation (4).

$$\begin{aligned}\log CEX_t &= a + b_1 \log FGR_t + b_2 \log TOP_t + b_3 \log FDI_t + b_4 \log EXR_t + b_5 \log TXN_t + b_6 \log INR_t \\ &+ b_7 \log POP_t + b_8 \log UNR_t + b_9 \log PDT_t + b_{10} \log OLP_t + b_{11} \log GDP_t + b_{12} \log CNS_t\end{aligned} \quad (4)$$

4.2.Sources of data

This study made use of secondary sourced data. The time series data were obtained from the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), Organization of the Petroleum Exporting Countries (OPEC), Federal Inland Revenue Service (FIRS), Debt Management Office (DMO), World Bank and United Nations Development Program (UNDP) statistical database. The annual statistical data from 1981 to 2020 on Construction Expenditure, Federal Government Revenue, Trade Openness, Foreign Direct Investment, Exchange Rate, Taxation, Inflation Rate, Population, Unemployment Rate, Public Debt, Annual Average Oil Prices, Real GDP and Construction Output were extracted.

4.3. Model estimation strategy

Performing tests of the null hypothesis using stationarity and the null hypothesis of a unit root is a prerequisite for analysing time series data in every econometric analysis (Kwiatkowski et al., 1992; Shrestha and Bhatta, 2018). To a large extent, the unit root determined the appropriate techniques to be applied in the data analysis (Jibir and Aluthge, 2019), and to avoid using non-stationary variables that will lead to spurious regression in the model (Granger and Newbold, 1974). Different techniques are used to determine the stationarity of time series data. In this study however, Dickey-Fuller with GLS Detrending (DF-GLS) (Elliott et al., 1996), Augmented Dickey- Fuller (ADF) (Dickey and Fuller, 1979) and Phillips-Perron (PP) (Phillips and Perron, 1988) techniques were adopted. This is because they are the commonest and simplest form of unit root test. Most importantly, in addition to being robust, PP has the ability to remove any autocorrelation from the unit root model (Arltová and Fedorová, 2016; Paparoditis and Politis, 2018). Since all the series were not expressed in the same unit, they were transformed into their natural logarithm for uniformity. The logarithm values were then used to test the existence of unit root.

Furthermore, to investigate the stable long-run equilibrium relationship between the variables, an autoregressive distributive lag (ARDL) model (Pesaran and Shin, 1999; Pesaran et al., 2001) was adopted and applied in this study. The ARDL model was selected over other models because of the following reasons. Firstly, ARDL model can be used without considering if the explained variables are I(1) or I(0). This indicates that it can be used to investigate mixed integration orders of the time series (Shrestha and Bhatta, 2018; Nkoro and Uko, 2016). Secondly, the ARD model yields unbiased estimates in the regression analysis which can be used for small sample data whereas, other models such as the Johansen co-integration require a large sample data to be valid. This implies that the model is robust when a single long-term relationship exists between the underlying variables in a small sample size (Pesaran and Shin, 1999; Pesaran et al., 2001; Nkoro and Uko, 2016). Thirdly, in the ARDL model, once the lag of the model is established, it enables the co-integration estimation by using an ordinary least squares model. Hence, the model can be used when the independant variables are endogenous and have power to correct any form of serial correlation (Ghouse et al., 2018). Finally, ARDL model allows estimation of dynamic effects from lagged dependent variables and lagged other explanatory variable(s) (Jibir and Aluthge, 2019).

Model of co-integration involves determining the presence of long-run relationship between the interacting variables by using F-test, and estimating the coefficients of long-run relationship, determining values of the constants, and estimating the short-run parameters of the variables by applying ECM (Pesaran and Shin, 1999; Pesaran et al., 2001). The error correction model (ECM) then helps in understanding the time taken for the adjustment to reach the equilibrium.

4.4.Model specification

For model specification, the model in Equation (4) was transformed and expressed in Equation (5).

$$\begin{aligned}\log CEX_t &= \alpha_0 + \alpha_1 \log FGR_t + \alpha_2 \log TOP_t + \alpha_3 \log FDI_t + \alpha_4 \log EXR_t + \alpha_5 \log TXN_t \\ &+ \alpha_6 \log INR_t + \alpha_7 \log POP_t + \alpha_8 \log UNR_t + \alpha_9 \log PDT_t + \alpha_{10} \log OLP_t + \alpha_{11} \log GDP_t \\ &+ \alpha_{12} \log CNS_t + \mu_t\end{aligned} \quad (5)$$

Where μ_t = error term and t = time trend consisting of years from 1981 to 2020. Meanwhile, the first stage when applying ARDL model is to assess the conditional ARDL specified in the model as presented in equation (6):

$$\Delta\log CEX_t = \alpha_0 + \alpha_1 \log CEX_{t-1} + \alpha_2 \log FGR_{t-1} + \alpha_3 \log TOP_{t-1} + \alpha_4 \log FDI_{t-1} + \alpha_5 \log EXR_{t-1} + \alpha_6 \log TXN_{t-1} + \alpha_7 \log INR_{t-1} + \alpha_8 \log POP_{t-1} + \alpha_9 \log UNR_{t-1} + \alpha_{10} \log PDT_{t-1} + \alpha_{11} \log OLP_{t-1} + \alpha_{12} \log GDP_{t-1} + \alpha_{13} \log CNS_{t-1} + \sum_{i=1}^{n} \beta_{i1}\Delta\log CEX_{t-1} + \sum_{i=1}^{n} \beta_{i2}\Delta\log FGR_{t-i} + \sum_{i=1}^{n} \beta_{i3}\Delta\log TOP_{t-i} + \sum_{i=1}^{n} \beta_{i4}\Delta logFDI_{t-i} + \sum_{i=1}^{n} \beta_{i5}\Delta\log EXR_{t-i} + \sum_{i=1}^{n} \beta_{i6}\Delta\log TXN_{t-i} + \sum_{i=1}^{n} \beta_{i7}\Delta\log INR_{t-i} + \sum_{i=1}^{n} \beta_{i8}\Delta\log POP_{t-i} + \sum_{i=1}^{n} \beta_{i9}\Delta\log UNR_{t-i} + \sum_{i=1}^{n} \beta_{i10}\Delta\log PDT_{t-i} + \sum_{i=1}^{n} \beta_{i11}\Delta\log OLP_{t-i} + \sum_{i=1}^{n} \beta_{i12}\Delta\log GDP_{t-i} + \sum_{i=1}^{n} \beta_{i13}\Delta\log CNS_{t-i} + \mu_t \quad (6)$$

Where α_0 = drift component, μ_t = stochastic error term, Δ = first different operator, α_{0-13} = long-run parameters, β_{1-13} = short-run parameters estimated from the ECM, n = optimal lag length and α_{1-13} = coefficients estimated from the model.

Subsequently, Equation (6) was applied to estimate the hypothesis that stated that there is no co-integration relationship between the variables against the alternative hypothesis that stated that there is long-run co-integration relationship between the variables. This is represented as

H_0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = \alpha_8 = \alpha_9 = \alpha_{10} = \alpha_{11} = \alpha_{12} = 0$

H_1: $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq \alpha_7 \neq \alpha_8 \neq \alpha_9 \neq \alpha_{10} \neq \alpha_{11} \neq \alpha_{12} \neq 0$

Applicable critical values were generated based on the number of explanatory variables in the model (Pesaran et al., 2001). In this case, two sets of critical values developed based on the assumption that the independent variables are $I(d)$ $(0 \leq d \leq 1)$ were compared against the computed F-stat. Meanwhile, the lower and upper critical values assumed that all the variables are $I(0)$ and $I(1)$ respectively. The criterion for F-test statistic is that if the calculated F-stat. is greater than the upper critical value, there would be a rejection of the null hypothesis of no co-integration. On the other hand, if the F-stat. is less than the lower bound, acceptance of the null hypothesis of no co-integration would be recommended. However, if F-stat. lies within the lower and upper critical bounds, the result would be inconclusive (Pesaran and Smith, 1997). But in order to determine the long-run coefficients, the transformation of Equation (6) was performed and presented as in Equation (7):

$$\log CEX_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \log CEX_{t-1} + \sum_{i=1}^{n} \alpha_2 \log FGR_{t-1} + \sum_{i=1}^{n} \alpha_3 \log TOP_{t-1} + \sum_{i=1}^{n} \alpha_4 logFDI_{t-1} + \sum_{i=1}^{n} \alpha_5 \log EXR_{t-1} + \sum_{i=1}^{n} \alpha_6 \log TXN_{t-1} + \sum_{i=1}^{n} \alpha_7 \log INR_{t-1} + \sum_{i=1}^{n} \alpha_8 \log POP_{t-8} + \sum_{i=1}^{n} \alpha_9 \log UNR_{t-1} + \sum_{i=1}^{n} \alpha_{10} \log PDT_{t-1} + \sum_{i=1}^{n} \alpha_{11} \log OLP_{t-1} + \sum_{i=1}^{n} \alpha_{12} \log GDP_{t-1} + \sum_{i=1}^{n} \alpha_{13} \log CNS_{t-1} + \mu_t \quad (7)$$

Furthermore, the short-run estimates of the ARDL model are specified and presented in equation (8):

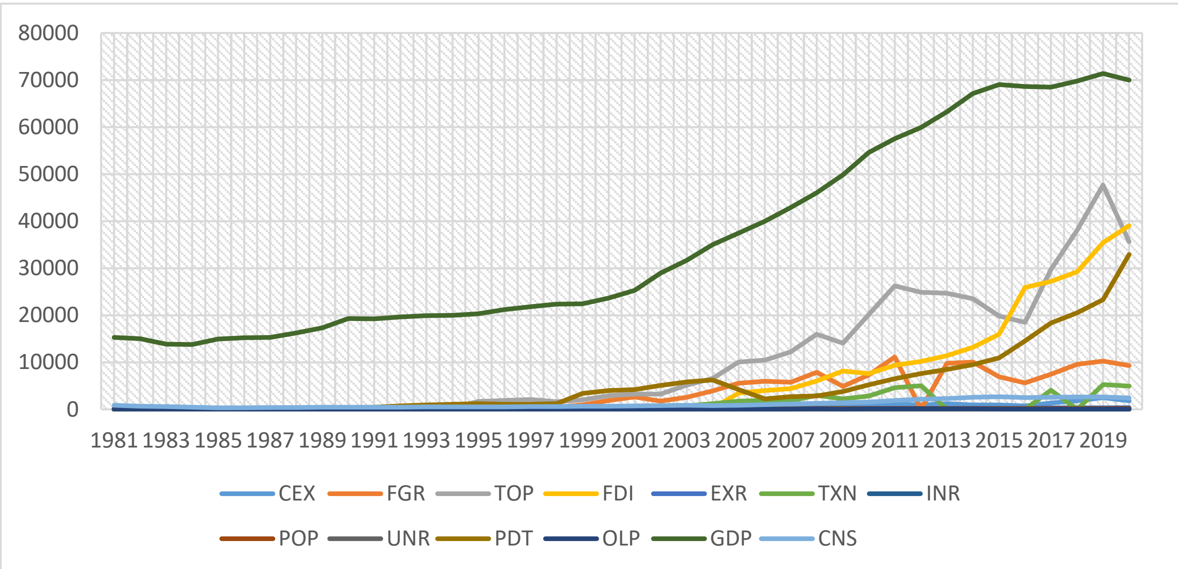
$$\Delta \log CEX_{t-i} = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta \log CEX_{t-i} + \sum_{i=1}^{n} \alpha_2 \Delta \log FGR_{t-i} + \sum_{i=1}^{n} \alpha_3 \Delta \log TOP_{t-i} + \sum_{i=1}^{n} \alpha_4 \Delta logFDI_{t-i} + \sum_{i=1}^{n} \alpha_5 \Delta \log EXR_{t-i} + \sum_{i=1}^{n} \alpha_6 \Delta \log TXN_{t-i} + \sum_{i=1}^{n} \alpha_7 \Delta \log INR_{t-i} + \sum_{i=1}^{n} \alpha_8 \Delta \log POP_{t-i} + \sum_{i=1}^{n} \alpha_9 \Delta \log UNR_{t-i} + \sum_{i=1}^{n} \alpha_{10} \Delta \log PDT_{t-i} + \sum_{i=1}^{n} \alpha_{11} \Delta \log OLP_{t-i} + \sum_{i=1}^{n} \alpha_{12} \Delta \log GDP_{t-i} + \sum_{i=1}^{n} \alpha_{13} \Delta \log CNS_{t-i} + \theta ECM_{t-i} + \mu_t \quad (8)$$

where Δ = coefficients of short-run dynamic to be determined, θ = speed of adjustment and ECM = error correction term.

5. Results and Discussions

5.1. Descriptive statistics

Figure no. 1 represents the trend of all the variables used in this study ranging from 1981 to 2020. The data visualization revealed the existence of an upward movement of the data series as the year increases in most cases. This indicated one of the characteristic of data containing a unit root. Hence there is need to check for the stationarity of the data using a more reliable tool. In this case, DF-GLS, Augmented Dickey Fuller test and Philip Perron Test were applied.



CEX (₦' Billion), FGR (₦' Billion), TOP (₦' Billion), FDI (₦' Billion), EXR (₦/US$)1.00), TXN (₦' Billion), INR (%), POP ('Million), UNR (%), PDT (₦' Billion), OLP (US$), GDP (₦' Trillion), CNS (₦' Billion)

Figure no. 1: Line trend of the variables data set (1981-2020)

Source: Authors' E-view 10.0 output.

The descriptive statistics in (Table no. 1) showed the average values of all the variables. The standard deviation revealed that Foreign Direct Investment (FDI), Trade Openness (TOP) and Federal Government Revenue (FGR) were the most volatile while Population (POP) was the least volatile. However, the deviations are marginally different from zero. It also revealed that FDI, INR, POP, UNR, OLP, GDP and CNS were positively skewed while CEX, FGR, TOP, EXR, TXN and PDT were negatively skewed. The result showed that the variable (INR) with the highest peak (2.95) is < 3 which indicates that there was no excess kurtosis in the data series of all the variables. The Jarque-Bera statistic indicated that the variables were normally distributed and statistically different from zero at 5% significant level (p>0.05).

Table no. 1: Descriptive statistics

Variable	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Observations
LogCEX	2.221956	0.885509	-0.564801	1.843667	4.355174	0.113315	40
LogFGR	2.874076	1.077442	-0.526927	1.785373	4.309878	0.115910	40
LogTOP	3.216040	1.171534	-0.530474	1.863022	4.030547	0.133284	40
LogFDI	2.259563	1.740513	-0.262828	1.796026	2.876448	0.237349	40
LogEXR	1.537548	0.865544	-0.797309	2.358331	4.924242	0.085254	40
LogTXN	2.501728	1.032150	-0.328838	1.655365	3.734301	0154563	40
LogINR	1.162535	0.297043	0.890608	2.951429	5.291812	0.070941	40
LogPOP	8.095985	0.132603	0.045207	1.797880	2.422113	0.297882	40
LogUNR	0.948475	0.365705	-0.202978	1.689456	3.137210	0.208336	40
LogPDT	3.166194	0.902108	-0.691387	2.490128	3.620055	0.163650	40
LogOLP	1.548488	0.289100	0.343565	1.847117	3.002147	0.222891	40
LogGDP	7.479340	0.252658	0.250628	1.525386	4.042906	0.132463	40
LogCNS	5.947807	0.298559	0.436220	1.791512	3.702663	0.157028	40

Source: Authors' E-view 10.0 output.

5.2. Unit root tests

The result of the DF-GLS unit root test is presented in (Table no. 2). The test regression included both intercept and trend and intercept for their level and first difference. (Table no. 2) revealed that when the DF-GLS test was estimated at levels with constant only, all the variables became non-stationary except INR. However, when estimated with constant and trend, none of the variables became stationary except INR and FDI.

The results indicated that the null hypothesis of non-stationary would be accepted at all levels except for INR in constant only model and INR and FDI in constant and trend model. Conversely, all the variables became stationary when the unit root test was performed after the first difference. In this case, the null hypothesis of non-stationary was rejected. This implies that at I(1) all the variables were stationary, however, INR and FDI were stationary at I(0). By this result, the adoption and application of ARDL model in estimation of the determinants of construction expenditure from the economic variables is justified.

Table no. 2: DF-GLS unit root test

Variable	At level		First difference		Order of integration
	Constant	Constant and trend	Constant	Constant and trend	
LogCEX	0.2307	-1.4555	-2.4733**	-6.0257***	I(1)
LogFGR	0.1704	-0.9949	-5.5821***	-6.5013***	I(1)
LogTOP	0.3653	-1.2766	-5.1558***	-6.3519***	I(1)
LogFDI	0.2349	-3.2761**	-8.8644***	-	I(0)
LogEXR	0.2448	-1.1993	-5.3203***	-5.6615***	I(1)
LogTXN	0.4968	-1.3621	-5.4740***	-6.4795***	I(1)
LogINR	-3.3886***	-3.6314**	-	-	I(0)
LogPOP	0.1409	-2.2724	-4.5578***	-4.5580***	I(1)
LogUNR	-0.4437	-1.8543	-5.1386***	-5.4168***	I(1)
LogPDT	0.6511	-1.4588	-3.6883***	-4.5751***	I(1)
LogOLP	-1.2758	-1.8218	-5.4046***	-4.6269***	I(1)
LogGDP	-0.2895	-1.7901	-2.6735***	-4.0982***	I(1)
LogCNS	-1.0083	-1.7263	-5.5822***	-4.9819***	I(1)

(a) Variables are in their logarithm form (b) ** and *** denote significance at 5% and 1% levels. (c) Akaike Information Criterion was used to determine the optimal lag length. (d) I(0) represents the order of integration at zero whereas I(1) represents the integration at order one.

Source: Authors' E-view 10.0 output.

Likewise, the result of the ADF unit root test is presented in (Table no. 3). The ADF test result at levels with constant only and with trend and intercept revealed that all the variables were non-stationary except INR for with constant only, and INR and GDP for with trend and intercept. This implies that the value of the test statistic was less than the critical values for the variables.

Table no. 3: ADF unit root test

Variable	At level		First difference		Order of integration
	Constant	Constant and trend	Constant	Constant and trend	
LogCEX	-0.8516	-1.3345	-6.4900***	-6.4829***	I(1)
LogFGR	-1.4146	-0.6743	-6.4915***	-5.3655***	I(1)
LogTOP	-1.1437	-1.0271	-6.5880***	-6.7600***	I(1)
LogFDI	-0.8944	-3.1749	-9.5780***	-9.5328***	I(1)
LogEXR	-2.1088	-1.3625	-5.2925***	-5.6706***	I(1)
LogTXN	-0.9978	-1.0770	-6.7254***	-5.5788***	I(1)
LogINR	-3.4481**	-4.4759***	-	-	I(0)
LogPOP	-0.0798	-2.2548	-4.4963***	-4.4334***	I(1)
LogUNR	-0.5593	-3.0788	-5.4593***	-5.4159***	I(1)
LogPDT	-2.5826	-2.1126	-4.5090***	-4.6039***	I(1)
LogOLP	-1.2567	-2.0977	-5.6072***	-4.6032***	I(1)
LogGDP	-0.4982	-3.8917**	-3.2617**	-	I(0)
LogCNS	-0.5953	-0.9023	-3.4715**	-3.7313**	I(1)

(a) Variables are in their logarithm form (b) ** and *** denote significance at 5% and 1% levels. (c) Akaike Information Criterion was used to determine the optimal lag length. (d) I(0) represents the order of integration at zero whereas I(1) represents the integration at order one.

Source: Authors' E-view 10.0 output.

The result further indicated that the null hypothesis of non-stationary was accepted at all levels except for INR and GDP. However, at first difference, all the variables were stationary. This implies that at 1% and 5% significance levels respectively, the computed test statistic values were greater than the critical values respectively. Consequently, the null hypothesis that stated that the variables are non-stationary were rejected. The result also implies that the variables were stationary at I(1), whereas INR and GDP were stationary at I(0). This result further justifies the application and adoption of ARDL model of co-integration in estimating the elements of the size of construction industry expenditure.

Moreover, when the PP test was conducted, the result agreed with the result of ADF, except that in with trend and intercept, CNS was stationary at level whereas other variables were stationary at first difference in both constant only and trend and intercept as represented in (Table no. 4).

The results of DF-GLS, ADF and PP therefore, confirmed that the variables were in I(0) and I(1). Since the variables were stationarity at level and first difference, it was theoretically right to compute the co-integration test using the ARDL Bound co-integration model to test if there is long-run relationship between the variables.

Table no. 4: PP unit root test

Variable	**At level**		**First difference**		**Order of integration**
	Constant	**Constant and trend**	**Constant**	**Constant and trend**	
LogCEX	-0.8464	-1.4289	-6.4868***	-6.4829***	I(1)
LogFGR	-1.5242	-0.4763	-6.4915***	-7.3418***	I(1)
LogTOP	-1.1637	-0.9560	-6.5880***	-6.9449***	I(1)
LogFDI	-0.9027	-3.2021*	-9.7282***	-10.0136***	I(1)
LogEXR	-2.2761	-1.3556	-5.2925***	-5.8278***	I(1)
LogTXN	-1.0146	-0.9495	-6.7467***	-7.0849***	I(1)
LogINR	-3.3283**	-3.2691*	-	-9.7671***	I(0)
LogPOP	-0.0881	-1.9798	-4.4963***	-4.4334***	I(1)
LogUNR	-0.6494	-2.1884	-5.4461***	-5.4006***	I(1)
LogPDT	-2.3622	-2.2688	-4.5142***	-4.6065***	I(1)
LogOLP	-1.2991	-2.1513	-5.5578***	-4.4390***	I(1)
LogGDP	0.2575	-2.4516	-3.1173**	-4.9001***	I(1)
LogCNS	-0.0587	-4.5020***	-3.3188**	-	I(0)

(a) Variables are in their logarithm form (b) ** and *** denote significance at 5% and 1% levels. (c) Akaike Information Criterion was used to determine the optimal lag length. (d) I(0) represents the order of integration at zero whereas I(1) represents the integration at order one.

Source: Authors' E-view 10.0 output.

5.3. ARDL bound test co-integration

The lag selection criteria for an annual data is normally between 1 and 2. The ARDL result was based on the Akaike information selection criterion (AIC) at lag 1 because it has the least information criterion (-40.82) as shown in (Table no. 5). (Table no. 5) revealed that the ARDL long-run bound estimate values of F-stat. (7.40) and t-stat. (-6.56) respectively were higher than both lower and upper bound critical values at 1%, 2.5%, 5% and 10% respectively. The result denotes the presence of co-integration between the variables in the model when the construction industry expenditure (CEX) is normalized as the dependent variable - F_{CEX} (FGR, TOP, FDI, EXR, TXN, INR, POP, UNR, PDT, OLP, GDP, CNS). Hence, the null hypothesis of no co-integration could not be accepted and the model indicated that a long-run equilibrium relationship was existing between the variables under consideration.

Table no. 5: Bound Test for the ARDL Model

F-Bounds Test (1, 1, 1, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0)		**Null Hypothesis: No levels relationship**		
Test Statistic	Value	Sig.	I(0)	I(1)
			Asymptotic: n=1000	
F-stat.	7.402618	10%	1.83	2.94
k	12	5%	2.06	3.24
		2.5%	2.28	3.5
		1%	2.54	3.86
t-Bounds Test (1, 1, 1, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0)		**Null Hypothesis: No levels relationship**		
Test Statistic	Value	Sig.	I(0)	I(1)
t-stat.	-6.562628	10%	-2.57	-4.69
		5%	-2.86	-5.03
		2.5%	-3.13	-5.34
		1%	-3.43	-5.68

Source: Authors' E-view 10.0 output.

5.4. Long and short-run relationship of the determinants of the construction industry expenditure

The result of the bound test has indicated that a long-run co-integration relationship was existing between the variables in the models. Therefore, the lag lengths for model selected based on AIC are (1, 1, 1, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0). At the long-run, the ARDL result in (Table no. 6) revealed that Exchange Rate (EXR), Construction Output (CNS), Inflation Rate (INR), Annual Average Oil Prices (OLP), Population (POP) and Trade Openness (TOP) have positive relationship with the size of construction industry expenditure, while Federal Government Revenue (FGR), Foreign Direct Investment (FDI), Taxation (TXN), Unemployment Rate (UNR), Public Debt (PDT) and Real GDP have negative significant association with the construction industry expenditure (CEX). However, at 5% significance level the result showed that FDI, EXR, OLP, PDT, POP, REAL GDP, TOP and UNR have significant long-run equilibrium relationship with the size of construction industry expenditure with coefficients of -0.495, 1.183, 1.006, -1.266, 14.482, -4.645, 1.369 and -0.756 respectively; and p-values of 0.0226, 0.0263, 0.0353, 0.0067, 0.0022, 0.0013, 0.0013, 0.0011 and 0.0092 respectively while CNS, INR, FGR and TXN did not. The implication of this result is that at the long-run a unit increase in EXR, OLP, POP and TOP would cause a corresponding increase in the size of construction industry expenditure, while a unit increase in FDI, PDT, REAL GDP and UNR would cause a decrease in the size of construction industry expenditure. It is obvious to equally note that at the long-run, a unit change in any of the insignificant variables may have an increase or a decrease effect on the size of construction industry expenditure no matter how trivial they may be. However, it suggested that growth in the federal government total revenue, construction output, inflation rate and tax revenue have not contributed in estimating the expansion of the size of construction industry expenditure in Nigeria in the long-run.

Table no. 6. Long-run relationship of the determinants of the construction industry expenditure

ARDL Long-Run Form
Dependent Variable: D(CEX)
Selected Model: ARDL(1, 1, 1, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0)
Case 3: Unrestricted Constant and No Trend

Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
logFGR	-0.472849	0.526481	-0.898132	0.3824
logFDI	-0.495491	0.196380	-2.523115	0.0226
logEXR	1.182829	0.483100	2.448416	0.0263
logCNS	0.386480	0.480900	0.803660	0.4334
logINR	0.083408	0.111094	0.750789	0.4637
logOLP	1.005568	0.437333	2.299322	0.0353
logPDT	-1.266058	0.406876	-3.111659	0.0067
logPOP	14.58183	4.001059	3.644491	0.0022
logGDP	-4.644503	1.196205	-3.882700	0.0013
logTOP	1.369306	0.345380	3.964643	0.0011
logTXN	-0.098858	0.525706	-0.188047	0.8532
logUNR	-0.756396	0.255285	-2.962945	0.0092

Source: Authors' E-view 10.0 output.

Interestingly, the positive and significant coefficient of exchange rate implies that the growing increase in the exchange rate would continue to raise the cost of providing construction infrastructure and thus, increasing the size of construction industry expenditure in Nigeria. The fact that the Nigerian economy including construction materials and components depends on how much Dollar is exchanged with Naira means that the size of construction industry expenditure would continue to expand since the exchange rate of Dollar/Naira keeps increasing. This further implies that the Nigerian government would continue to spend more on the provision of infrastructure for her people. The result suggested that the depreciating value of Naira against the strong Dollar would lead to increasing amount of money spent in providing construction industry products in Naira terms. This result supports Omodero (2020) who found that exchange rate has significant positive influence on capital expenditure. And contrary to Jibir and Aluthge (2019) who found a negative and insignificant relationship.

The positive and significant coefficient of annual average oil price was established on the fact that the Nigerian economy strongly depends on oil revenue and consequently, the price of oil in the global market controls the government commitment to provision of construction infrastructure. That is to say that if the oil prices increases, there is tendency for the government to increase their budget for the provision of public infrastructure and thereby, increasing the size of construction industry expenditure. Hence, since there is an increase in the global oil prices over the years irrespective of the effects of 2008 global economic crisis, recent fall in the global oil market and current COVID-19 pandemic, it is not out of place if Nigerian government steadily increases its size of construction industry expenditure over the years and continue to do so as long as oil price continue to rise. This result is also in tune with Jibir and Aluthge (2019) and Aladejare (2019) who revealed that oil price is one of the major determinants of government expenditure.

The positive and significant coefficient of population indicated that government commits a lot of resources in providing construction industry products in the form of infrastructure. As a result, the increase in the population brings about the need to increase government spending in the provision of infrastructure for the people. The fact that Nigerian population keeps increasing yearly means that the citizenry will continue to demand for more public infrastructure like roads, housing of different type and other public amenities in line with the demands of the rising population of the country. The result aligns with Edame, et al. (2014), Obeng and Sakyi (2017) and Jibir and Aluthge (2019) but went contrary to Omodero (2020).

A positive and significant long-run association found between trade openness and the construction industry expenditure could be as a result of excessive exposure to shocks emanating from foreign countries through trade openness and which inadvertently, increases the government expenditure in the provision of construction infrastructure. The fact that every government especially the developing nations would desire to provide more public amenities to people to improve their standard of living would also make them to subject to the foreign shocks arising from trade openness. When a country depends on foreign trade, it increases the volatility on domestic markets arising from the development of its trading partners (Maluleke, 2017). Furthermore, greater trade openness would lead to demand for more construction industry products such as roads, housing for social and public services, electricity and other public utilities for sustainable living. The result is in line with Edame et al. (2014) and Jibir and Aluthge (2019), but contradicts Foye (2014).

However, a negative and significant coefficient of foreign direct investment was as a result of decreasing value of Naira due to increasing exchange rate. The decreasing amount of FDI into the country would cause the government to increase its spending in construction activities due to increasing population and demands for public infrastructure. Besides, the dwindling amount of FDI due to increasing exchange rate does not stem the tide of need for more construction industry products; rather the result showed that the need keeps on progressing and thus increasing the size of construction industry expenditure. This result agrees with Foye (2014).

The coefficient of public debt depicted the existence of a negative and significant long-run association between public debt and the size of construction industry expenditure. This suggests that the rise in public debt could help in explaining the decrease in the size of construction industry expenditure in Nigeria. Although this finding supports the theoretical supposition that states that public debt sways the contraction of public spending through servicing of public debt (Foye, 2014; Omodero, 2020); the result suggested that the servicing of public debt as provided in the yearly budget in Nigeria is misapplied. This could be due to corruption in the system of governance in Nigeria where public funds are siphoned into private pockets and thus leading to the decrease in the provision of public infrastructure. In the instance case, the Government misappropriated debt to cover the revenue deficit instead of as a means of increasing spending. On the other hand, the result suggested that external debt is having importance influence in the allocation of government budget in Nigeria. In this case, the result disagrees with Aregbeyen and Akpan (2013) and Okafor and Eiya (2011) whose studies indicated the existence of strong correlation between public debt and growth in the size of public expenditure. The result partly supports Jibir and Aluthge (2019), but disagrees in the sense that public debt is a significant determinant of public expenditure including construction industry expenditure.

A negative and significant coefficient of real GDP indicated that the growth of Nigerian economy has not reflected in the government commitment in terms of increasing the size of construction industry expenditure through provision of infrastructure in Nigeria. Since the growth in economy could not to translated into increasing government spending in terms of capital budget, this suggested that the growth could either be artificial or there is a misapplication of resource by the Nigerian economic managers. This goes contrary to the Wagner's proposition in terms of increasing construction sector expenditure as a result of growth in real GDP. This result confirms the result of Okoye et al. (2021) but refutes Jibir and Aluthge (2019). The fact that increasing capital budget in Nigeria does not depict the growth in the size of infrastructural development affirmed that resources made for construction projects might have been diverted to other places or used for private purposes. There could also be a case of inappropriate policies and planning on the part of Nigerian economic planners, police makers and economic managers as pointed out by Aladejare (2019).

Likewise, the negative and significant coefficient of unemployment signified the consequential negative impact of unemployment on the infrastructure development in Nigeria. That is to say that as unemployment continue to increase, there would be a corresponding dwindling of fortune of construction industry development through decrease in government spending on infrastructure provisions in the country. This result aligns with Okoye et al. (2021) whose result suggested that government spending on provision of infrastructure was not directed towards reducing unemployment in Nigeria.

The fact that construction output showed insignificant positive relationship implies that an increase in construction activities by the government supposed to cause an increase in the size of public spending in providing more construction projects. However, this result proved that this is not the case in Nigeria since the growth in the economic does not depicts developmental progression contrary to the proposition of Wagner. Another interesting result is the negative though insignificant relationship between the construction industry expenditure and federal government revenue and taxation. What this portended is that revenues including taxes collected in Nigeria were being diverted or channelled into other areas other than to infrastructural development. It also suggested that there is disconnect between collecting revenue and taxes, budget allocation and implementation. This could be the reason Nigeria is still very backward infrastructure wise despite posting big economic data in terms of revenue and economic growth. This result therefore, disagrees with Edame, et al. (2014), Jibir and Aluthge (2019), and Ukwueze (2015) who found that government revenue and taxes influences government spending positively.

The short-run ARDL Result in (Table no. 7) indicated that the model passed the three basic error correction criteria: being less than 1 and being statistically significant and negative. The result of F-stat. (F-stat. = 20.74, p=0.0000) however, revealed that there is a joint significant influence of explanatory variables on the overall size of construction industry expenditure in Nigeria. It also implies that the model is statistically significant. This result confirmed that a long-run equilibrium relationship exists between socio-economic (the explanatory) variables and construction industry expenditure in Nigeria.

The R^2 estimate of 0.8811 was very high which indicates that the model was a good one and the explanatory variables included in the model were important determinants of the dependent variable. However, the coefficient of adjusted R^2 (0.8386) implies that about 83.86%. of the total variations of the size of construction industry expenditure could be expressed by the determinant variables in the model, whereas the 16.14% remaining could be said to be negligible and attributed to other relevant variables not present in the model but expressed as part of error term. The Durbin-Watson statistic value of 2.5754 that follows the rule of thumb showed that the model is free from the first order autocorrelation problems. The overall result suggested that the size of construction industry expenditure in Nigeria is a function of many socio-economic variables. This could be ascribed to the multi-dimensional socio-economic significance of construction industry in Nigeria.

Expectedly, the Error Correction Coefficient CointEq(-1) = -0.9856, p=0.0000<0.05) appeared with a negative sign. The ECM result revealed that in the event of shock, about 98.56% of the disequilibrium between the size of construction industry expenditure and its determining variables in the model could be corrected in one year. The result suggested that the speed at which the model adjusted from short-run to long-run equilibrium was high. It implies that the equilibrium state in the model could be attained within two years. Since about

88.11% of changes in the size of construction industry expenditure in Nigeria were explained by the independent variables incorporated in the model, this result confirmed the importance socio-economic variables in estimating the size of construction industry expenditure in Nigeria.

Table no. 7. Short-run relationship of the determinants of the construction industry expenditure

ARDL Error Correction Regression
Dependent Variable: D(CEX)
Selected Model: ARDL(1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 0)
Case 3: Unrestricted Constant and No Trend

ECM Regression
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-82.60162	6.372364	-12.96248	0.0000
D(logFGR)	-0.083074	0.172185	-0.482469	0.6360
D(logFDI)	-0.235739	0.039817	-5.920576	0.0000
D(logEXR)	-0.235739	0.101440	-2.323939	0.0336
D(logCNS)	0.189879	0.296183	0.641087	0.5305
D(logINR)	-0.013186	0.036671	-0.359580	0.7239
D(logOLP)	0.189879	0.143975	1.318827	0.2058
D(logPDT)	-0.471420	0.102491	-4.599628	0.0003
D(logPOP)	-1.944115	4.767851	-0.407755	0.6889
D(logGDP)	0.974950	0.663093	1.470307	0.1609
D(logTOP)	0.380677	0.120314	3.164035	0.0060
D(logTXN)	0.305199	0.152351	2.003272	0.0624
D(logUNR)	0.305199	0.397830	0.767160	0.4542
CointEq(-1)*	***-0.985646***	***0.075952***	***-12.97727***	***0.0000***

R-squared	0.881060	Mean dependent var	0.058960
Adjusted R-squared	0.838581	S.D. dependent var	0.143324
S.E. of regression	0.057583	Akaike info criterion	-2.638424
Sum squared resid	0.092843	Schwarz criterion	-2.169215
Log likelihood	62.44928	Hannan-Quinn criter.	-2.470076
F-stat.	20.74119	Durbin-Watson stat	2.575409
Prob(F-stat.)	0.000000		

Source: Authors' E-view 10.0 output.

Furthermore, the result revealed that at lag 4, Trade Openness with coefficient of 0.381 and associated p-value of 0.0060 has positive and significant short-run effect on the size of construction industry expenditure in Nigeria. The result also revealed that FDI, EXT and PDT with coefficients of -0.236, -0.236 and -0.471, and associated p-values of 0.0000, 0.0336 and 0.0003 respectively have negative and significant short-run effect on the size of construction industry expenditure in Nigeria. It implies that at the short-run an increase in TOP would cause a corresponding increase in the size of construction industry expenditure, whereas a unit growth in FDI, EXT and PDT would lead to a decline in the size of construction industry expenditure in Nigeria. This result implies that that at short-run, only TOP, FDI, EXT and PDT contributed to the explanation of size of construction industry expenditure in Nigeria. This is contrary to what was obtained in the long-run. A lot of reasons can be attributed to this result. For instance, the objective of promoting sustainable growth and development through infrastructural development to improve the welfare of Nigerian citizens has not been achieved despite running deficit budgets over the years due to perennial corruption, dysfunctional economic policies, inefficient budgetary system etc. Hence, the level of public infrastructure is not proportionate to the amount of public expenditure in Nigeria (Edame et al., 2014). This result totally supports Jibir and Aluthge (2019) and Aladejare (2019) in terms of exchange rate in the sense that the sustained increase in exchange rate has a negative and significant effect on government activities. It partly aligned with Jibir and Aluthge (2019) in terms of positive and negative effects of trade openness and public debt respectively but disagreed with them in that both trade openness and public debt were important determinants of construction sector expenditure in short-run.

5.5. Diagnostic Check

To determine the appropriateness and robustness of the estimates, several residual diagnostic tests were conducted and presented in (Table no. 8). They include: the autocorrelation test, the heteroscedasticity test, the normality and stability tests. The result of Breuch-Godfrey LM Serial Correlation test however, revealed that the null hypothesis of no autocorrelation was accepted, because the computed F-stat. test was 1.7885 and the probability value was 0.2034 ($p>0.05$) for the model. Furthermore, there was no serial correlation in the model, implying that the estimated regression result was not misleading or spurious. The heteroscedasticity ARCH tests result also revealed that the model passed the test for heteroscedasticity with F-stat. (0.6603) and p-value of 0.8193 which is greater than critical value ($p>0.05$).

Table no. 8: Residual Test

Breusch-Godfrey Serial Correlation LM Test:

F-stat.	1.788536	Prob. F(2,14)	0.2034
Obs*R-squared	7.936807	Prob. Chi-Square(2)	0.0189

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-stat.	0.660320	Prob. F(22,16)	0.8193
Obs*R-squared	18.55911	Prob. Chi-Square(22)	0.6724
Scaled explained SS	3.364145	Prob. Chi-Square(22)	1.0000

Source: Authors' E-view 10.0 output.

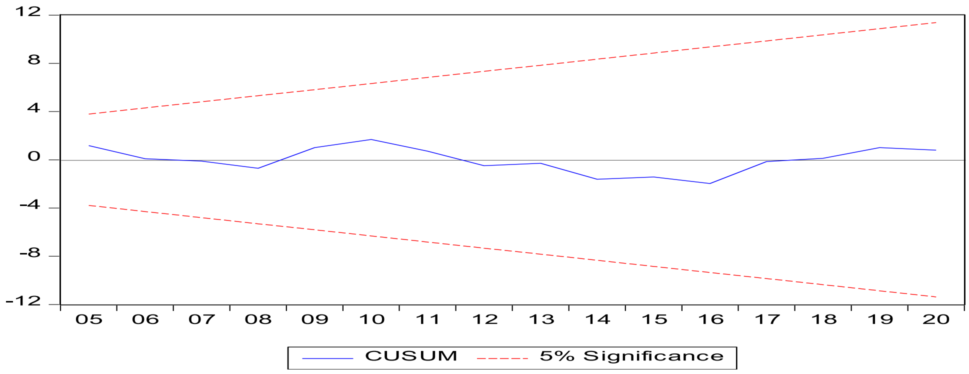


Figure no. 2: CUSUM Test

Source: Authors' E-view 10.0 output.

The cumulative sum (CUSUM) recursive test presented in (Figure no. 2) showed that the series estimates were within limits and lied within the 5% significant level. This indicated that the model used is dynamically stable and that the null hypothesis that the model for the estimates of the size of construction industry expenditure in Nigeria is stable cannot be rejected at 5% significance level. Hence it implies that the model couldbe used for estimating the size of construction industry expenditure in Nigeria.

6. Conclusion

The fact that every year government budgets huge sum of money for capital projects ought to have been reflected in the infrastructural development of the country. However, the reverse seems to be the case due to a lot of contending factors. As the size of capital expenditure keeps increasing, this study has examined the determinants of size of construction industry expenditure in Nigeria using economic data from 1981-2020. The result of this study is revealing and stimulating. Firstly, the study has found the existence of a long-run co-integration in the model between the interacting variables. It however, provided a partially supports Wagner's law in the sense that certain incremental government activities led to increase in government spending on construction infrastructure while it was not the same in some other cases in both long and short-runs. The study suggested that the estimates of exchange rate, annual average oil prices, population, trade openness, foreign direct investment, unemployment rate, public debt and real GDP are important determinants of the size of construction industry expenditure in Nigeria. Conversely, estimates of construction output, inflation rate federal government revenue and taxation were found to have insignificant effect in determining the size of construction industry expenditure in Nigeria due to issues bothering on policy, management and implementation of capital budget.

The significance effects of exchange rate, trade openness, foreign direct investment and public debt implies that the Nigerian fiscal and monetary policies are dependent on the foreign or external forces. It also suggests that using internal economic control mechanisms in checking economic shocks in Nigeria might be very difficult due to unfavourable external influence. This suggests that Nigeria needs serious economic policy rejig and manoeuvring to fix incongruous economic policies in Nigeria. The onus lies in the hands of political leaders, economic and financial experts, policy makers and economic managers in Nigeria to avoid policy summersault. Further implication of the effect of public debt pointed to the improper handling of external debt servicing or misappropriation of debt servicing budget. This highlighted the effect of endemic corruption in the government systems which requires diligence in the management of public fund and strengthening of anti-corruption agencies in Nigeria.

The significant positive relationship between population and the size of construction sector expenditure signifies that government needs to step-up its campaign towards reducing family size through advocacy, population reduction policies and legislations. This would help to reduce the pressure of population explosion arising from increasing demand for public infrastructure. The long-run effect of oil price implies that Nigerian economic is still rooted in the revenue arising from oil sale as a result, exogenously controlled by the global oil price fluctuation. This therefore, calls for sincere effort towards making sure that the diversification of the revenue base in Nigeria is achieved to stem the consequential enduring effect of oil revenue flux in Nigeria. The significant negative and positive effects of real GDP and unemployment respectively implies that there are bad government expenditure decisions and misplacement of priority in the allocation of public budget in Nigeria. For increasing real GDP to reflect in the infrastructural development in Nigeria requires policy rework and diligence in allocation and implementation of capital budgeting. Likewise, increasing public expenditure is expected to reduce the rate of unemployment in the country. Based on the foregoing findings, this study made a case for Nigerian government to direct its efforts towards making and implementing apposite policies that would ensure sustainable economy through increasing infrastructural development.

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