



ANALYSIS OF THE EFFECTS OF CORRUPTION AND ELECTRICITY ACCESS ON ECONOMIC GROWTH IN NIGERIA

***SAMAILA ADAMU; & **RILWANU MOHAMMED**

**Department of Economics and Development Studies, Federal University of Kashere, Gombe State, Nigeria. **School of General Studies, Economics Program, Abubakar Tatari Ali Polytechnic, Bauchi, Bauchi State, Nigeria.*

Abstract:

The study is on the analysis of the effects of corruption and electricity access on economic growth in Nigeria covering 2002Q1 to 2018Q4 time series data. The unit root properties of the series were tested using Augmented Dickey Fuller (ADF), Philips Perron (PP) and Zivot-Andrews breakpoint unit root test. Chow test revealed presence of structural break in 2015 which was taken care of by the introduction of dummy variables and interaction terms. The results from Autoregressive Distributed lag (ARDL) and Dynamic Ordinary Least Square (DOLS) cointegrating regression revealed that control of corruption and access to electricity have positive and statistically significant long run effects on economic growth in Nigeria, but the short run ARDL results indicated that electricity access and corruption control harm economic growth in Nigeria over the study period, with slow speed of adjustment to long run equilibrium of 2.63% quarterly. This study concludes that corruption is sand in the wheels of Nigeria's economic prosperity and therefore recommends continued effort in control of corruption and increase in electricity supply for more economic growth among others.

Keywords: *Economic Growth, Corruption, Electricity, Time series, Chow test.*

INTRODUCTION

Economic growth of any country is a function of many variables in the country, some of which are; human and natural resources endowments, the access to

energy for execution of the productive activities and the hitch-free flow and synergy among the key institutions, regulations, efficient and objective bureaucratic set up in the economy among others. But, in presence of corruption, some hypothesized economic backwardness even with abundant resources, for instance Sharma and Mitra (2019) opined that resource endowment is not beneficial when a high level of corruption and poor regulation prevails in a country, this assertion may be applicable to Nigeria given the abundance of human and material resources (petrol, gas, gold, arable land, etc), yet no appreciable economic prosperity relative to the wealth in the country, but to be very precise, that is subject to empirical verification of this study.

While others opined the imperativeness for inclusion of some elements of corruption into growth equation to grease the wheels of economic prosperity especially when regulatory institutions are not doing well, among the proponent of this hypothesis are Leff (1964), Huntington (1968), Sharma and Mitra, (2015) among others. They are of the view that good projects that are capable of enhancing the economic performance may not be approved if some grease money is not given as enticement for smooth approval of contracts, implementation of growth enhancing policies and programmes.

In Nigeria, many laudable projects like Ajaokuta steel company with delivery date of 1986, Styr Nig Ltd automobile plant in Bauchi, Second Niger Bridge , dredging of Baro Port in Niger state, and programmes such as National Poverty Eradication Programme (NAPEP), 7-point agenda for Nigeria's Growth and Development and so on, have been abandoned or restarted afresh by successive governments in a bid to be able to assign or approve fresh ones perhaps due to unmerited intentions for financial and or political gains or simply due different forms of corruption (Adegboyega, 2017), it is therefore assumed that corruption obstruct productive activities and economic growth. Corruption is one of the greatest threats to good governance today because it slows down economic growth and investment (Iyoha, et al 2015).

Corruption is further seen by the economic and financial crimes commission of Nigeria (EFCC) as a cankerworm that gradually and silently destroying the fabrics of a nation's economy as well as reducing development in all sectors (EFCC, 2005). Independent Corrupt practices and other related offences commission further cemented the EFCC position by stating that corruption is the major cause of the underdevelopment in Nigeria ICPC (2006).

However, an alternative views supports position that corruption may be beneficial in the less developed economies or second best world where there are distortions due; to inefficient bureaucracy and regulatory system, ill-functioning institutions which via corruption or a popular hypothesis of greasing the wheels might trigger economic prosperity (Huntington, 1968; Leff, 1964, Sharma & Mitra, 2015) in such economies.

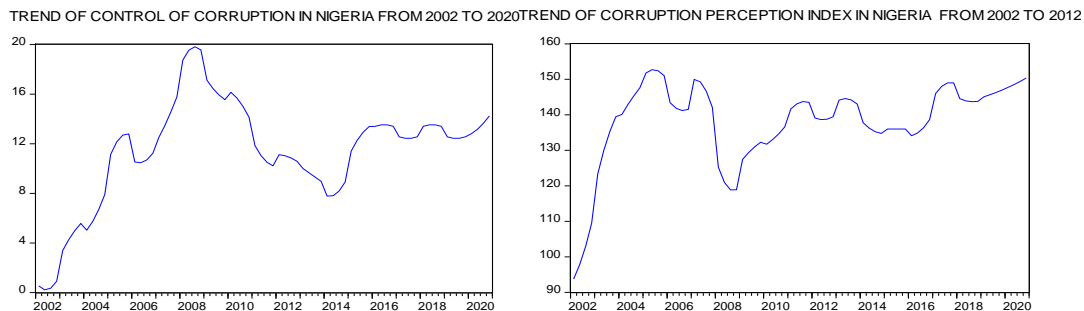


Fig 1: Trend of Nigeria’s Corruption Control and Corruption Ranking

The basis for starting with 2002 values is for uniformity of the variables, although some of the control of corruption index and corruption perception index values from 1996 are available, but Nigeria’s 1997, 1999, and 2001 values of control of corruption are not available from the world governance indicators which is the source of data for control of corruption in this and other studies that used such indicator.

It can be deduce from the trends of both control of corruption and the corruption index that positive trend were exhibited by both, that is, despite some level of control of corruption in Nigeria following the activities of independent corrupt practices and other related offences commission (ICPC) and Economic Financial and Crime Commission (EFCC) that were established to fight corruption in 2000 and 2003 respectively. ICPC target mainly corruption in the public sector while EFCC investigate people in all sectors who appear to be living beyond their means of earning, despite these efforts, trends of corruption in the country continue to be upward moving and appears to be having effects on various sectors of the economy. Thus, paving way for empirical investigation to explore and unveiled evidenced based implication of corruption on economic growth in Nigeria, given that some are in position that says corruption “grease the wheels” of economic growth (Leff, 1964, Huntington,1968) while others believes contrary, that corruption “sands the

wheels” meaning corruption decreases economic growth through prevention of efficiency in production and innovation known as “sand in the wheel hypothesis” (Mauro, 1998; Svensson, 2005).

Furthermore, data from world bank development indicators points that countries with high access to electricity were seen to be better off in terms of economic prosperity than those with low access to electricity, below are some of the world giants in terms of GDP per capita and even some African countries that for more than decade passed Nigeria in terms of electricity access and economic performance based on GDP per capita.

Table1: Countries levels of Access to Electricity and Economic Growth measured by GDP per capita (constant 2015 US\$)

Country	Indicators	2000	2010	2018	2019
U.S.A	Electric Access(%)	100	100	100	100
	GDP per cap.(US,\$)	48,689.0	52,759.9	59,821.6	60,836.8
CHINA	Electric Access(%)	96.9	99.7	100	100
	GDP per cap.(US,\$)	2,193.9	5,647.1	9,688.5	10,228.3
South Africa	Electric Access(%)	72.3	82.9	84.7	85
	GDP per cap.(US,\$)	4505.9	5561.5	5639.9	5574.6
Egypt	Electric Access(%)	97.7	99.5	100	100
	GDP per cap.(US,\$)	2610.5	3472.6	3831.20	3965.0
Nigeria	Electric Access(%)	42.9	48.0	56.5	55.4
	GDP per cap.(US,\$)	1450.8	2403.6	2512.2	2502.7

Source: Authors’ (2021) Extracted from World Bank indicators (2021), www.data.worldbank.org

From table 1 above, it can deduced that all the countries recorded for more than two decades higher access to electricity and economic growth as measured by GDP per capita than Nigeria. The indicators further points that higher access to electricity goes with higher GDP per capita. This suggest the need for more electricity in order to achieve higher economic growth in Nigeria, but an empirical econometric estimations is need for informed and verifiable policy guide which this study is going to undertake in the subsequent part of this study.

THEORETICAL AND EMPIRICAL REVIEW

Policy-Oriented Theory

Teveik, Albert and Charles (1986) propounded the Policy-Oriented theory probing and clarifying the role of government in the fight against corruption. The theory thus state that; the recurrent incident of corruption in government and private sectors in both developing and developed economies has a resultant effect on economic and financial growth of a nation. It buttress that high corruption level in any economy will not allow the economy to prosper, thus appropriate administrative framework and methodology to gauge the effects of corruption on economic growth is imperative. According to the theory, to deal with corruption problem in any society, bureaucratic challenges, slow justice and poor social demands of members of the society must be dealt with in analyzing corrupt practices.

Further corruption theories as cited from the work of Ighodaro and Igbinedion (2020), some of these theories worth considering by this study are; public choice theory of corruption, organizational theory of corruption and the bad apple theory of corruption. The choice of these theories is informed by the very nature of Nigeria and Nigerians, which all the captured theories significantly unveiled.

Public choice theory

The public choice theory that was made popular by Rose-Ackerman (1978), the theory opined corruption tends not to end so long as the benefit from corruption out weights the consequences or punishment if caught. To Klitgaard (1988), people will continue to be corrupt whenever the advantages from being corrupt are more than the disadvantages, as such there should be severe and indiscriminate punishment for whosoever commit corruption.

The organizational culture theory

This theory is of the view that people that are not corrupt may become corrupt when they find themselves in a corrupt environment, meaning corruption is the cause of corruption. Perhaps, this is why Jackall (1988); Punch (2000) opined that not becoming corrupt in certain organizational cultures means betraying the group. Hence, Huberts, Kaptein and Lastuizen (2004) noted that to fight corruption in organizations, you alter the organization' leadership.

The Bad Apple theory of Corruption

The theory considers corruption at the individual level or kind of association determined the engagement of person in corrupt practice, or corruption is a function of human short-comings such as greediness (de Graaf 2003).

Theoretical Framework: “Grease the Wheels” and “Sand the Wheels” Hypothesis

The study concentrates and evaluates the greasers and sanders hypothesis given the objective stands of the hypothesis that corruption may be for or against economic growth. As the name implies, there are two opposing hypothesis, one that says corruption “grease the wheels” or enhance economic growth (Leff, 1964, Huntington,1968) the other believes that corruption “sands the wheels” meaning corruption decreases or obstruct economic growth through prevention of efficiency in production and innovation known as “sand in the wheel hypothesis” (Mauro, 1998; Svensson, 2005).

Conceptual Review

Corruption can be defined as encompassing all forms of irregular, unethical, immoral and/or illegal practices and transactions, dealing and activities in the process of handling commercial or public transactions or in the performance of official duties (Adegboyega, 2017). It is the dishonest or fraudulent conduct by those in power, typically involving bribery. It is the illegitimate use of power to benefit a private interest (Morris 1991). World Bank (1997) defines corruption as the abuse of public office for private gains or to circumvent public policies and processes for competitive advantage and profit. Also, it can be abused for personal benefit through patronage, nepotism, the theft of state assets or diversion of state revenue. Also, corruption is the abuse of public trust for private gain; it is a form of stealing (Todaro and Smith, 2003). In addition,

Transparency International adopts a more detailed approach by describing corruption as behavior on the part of officials in the public sector, whether politicians or civil servants, in whom they improperly and unlawfully enrich themselves, or those close to them, by the misuse of the public power entrusted to them as such, corruption is the misuse of delegated authority for personal benefits (Transparency International, 2011). Natalia (2016) posits that corruption includes bribery, extortion, and misuse of insider information and thrives where policy enforcement is lacking.

Economic growth can be defined as the increase in the monetary or market value of goods and services produced by an economy over time. According to Todaro and Smith (2009), economic growth is an expansion of the system in one or more dimensions without a change in its structure. Ajayi (1996) define economic growth as the increase in a country's real output of goods and services over a period of time. Ijirshar (2015) perceived economic growth as an increase in the capacity of an economy to produce goods and services, compared from one period of time to another which can be measured in nominal terms (including inflation) or in real terms (adjusted for inflation).

Empirical Review

Corruption and Economic growth

Rotini, Obasaju, Lawal, and Ise (2013) stipulate that, there is no correlation between corruption and economic growth in real output. While, Ngutsav (2018), used Vector Error Correction Model and Impulse Response Function in investigating the effect of corruption to economic growth through government expenditure in Nigeria covering 1981 to 2015, corruption was found to have negative effect on economic growth.

Between 1999 to 2016, Ben *et al* (2018) employed linear regression model on economic growth (GDP), corruption (corruption index) and other independent regressors, the result showed positive and significant relationship of corruption to economic growth in Nigeria. Specifically the corruption parameter estimate revealed 0.997 coefficients, meaning for a unit increase in corruption index, there will increase in economic growth by 0.997 units. The unit result of the variables were mixture of both level stationary (I(0)) and first order (I(1)) integrated variables (combination of) with only GDP variable being I(0), yet the study proceed to estimate the model via linear regression. In fact the log of

exchange rate was reported to be insignificant with reported ADF probability value of 0.104.

Omodero and Dandago (2018), the study examines the effect of corruption on the stock market performance in Nigeria using corruption perception index and Nigeria corruption ranking as proxies. The study employed time series data covering 1996 to 2016, Multi-regression analysis and student t-test findings showed a significant positive correlation between corruption and stock market performance in Nigeria.

Sharma and Mitra (2019) assesses the impact of corruption control and regulation quality on growth across countries over the period 1996 through 2015 on a sample of 103 countries across the globe, empirical findings suggests positive effects of corruption control (CC) on economic growth as revealed by Difference Generalized Method of Moments (GMM) model. But the study revealed the existence of statistically significant coefficients of interaction terms used for corruption and resource abundance and corruption, resource abundance and regulation quality have negative for the overall sample, indicating that high resource base does not benefit countries in the presence of high corruption.

Erum and Hussain (2019) examine nexus between corruption and economic growth by incorporating the role of natural resources and ICT diffusion in Organization of Islamic Cooperation (OIC) member countries from 1984 to 2016 using Cross-sectional ARDL estimation technique (Under this approach, three estimators for P-ARDL are estimated includes mean group (MG), pooled mean group (PMG) and dynamic fixed effects (DFE) is applied after Westerlund (2007) panel cointegration test. The long-run and short-run findings of the study revealed that corruption is detrimental to economic growth for OIC member countries.

Igiebor (2019) Corruption in Nigeria has negatively affected the country's economic development. To change this situation, the leadership must genuinely commit to fighting corruption from the top down; corruption control mechanisms need to be strengthened, the offenders need to be punished, and the citizenry needs to be mobilized to demand transparency and accountability.

Qureshi *et al.* (2020) revisited the connection among corruption, economic growth, and foreign direct investment, in developing and developed markets by applying panel vector autoregressive technique and Generalized Method of Moments (GMM) as a robustness check on data spanning 1996 to 2018. Finding

showed that economic growth and corruption have a positive bidirectional relationship for developing countries and negative unidirectional association for developed countries. A unidirectional causality is perceived from economic growth to corruption for developed economies.

Electricity and growth

Bidirectional causal nexus between electricity consumption and economic growth was established in Nigeria between 1980 to 2008 by Ogunjipe and Apata (2013) using pairwise granger causality test. Iyke (2015), results from investigation of the causal connection between electricity and economic growth in Nigeria confirmed electricity-led growth hypothesis (more electricity more economic growth) with the aid of Vector Error Correction Model (VECM) over the period of 1971 to 2011. Empirically electricity was also found to positively enhance industrial output and labour employment, which by extension can enhance economic growth in Nigeria (Olufemi, 2015).

Nathaniel and Bekun (2021), explored the nexus between electricity consumption, urbanization and economic growth in Nigeria covering 1971 to 2014, the study applied ARDL bounds test, Fully Modified OLS (FMOLS), Canonical Cointegration Regression (CCR) and Dynamic OLS (DOLS). Electricity consumption was found to increase economic growth from all the models. Granger causality support short run neutrality and long-run feedback hypothesis between electricity and economic growth; however corruption was not part of the explanatory variables despite the perceived role it may play in determining economic performance.

METHOD AND MATERIALS

The method and procedures used by the study are explained in this section. The study applied Chow (1960) single structural break test to check for structural break on the basis of 2015 regime change in Nigeria, given that since 1999 the country was led by a different political party with different economic policy dimension and priorities. Augmented Dickey Fuller (ADF) and Phillips Perron (PP) (Phillips & Perron, 1988) unit root tests were used for unveiling the stationarity of the series; in addition Zivot-Andrews (1992) unit root test with break point is also applied. Then, for the parameter estimates, provision for accounting for structural break is made by introduction of dummy variables and interaction terms with Autoregressive Distributed Lag (ARDL) bounds test

employed for cointegration test as well as short-run and long-run parameter estimates of the coefficients. The long run ARDL estimates are further supported by Dynamic Ordinary Least Square (DOLS) as robustness check followed by post estimation diagnostics of the models. DOLS is has the advantage of handling small sample averting residual non-normality, simulteity and endogeneity bias.

Chow Test, Dummy variables and Interacting Terms

The chow break point test was applied the year 2015, if break is confirmed, then to account for it and correct the structural break, the study generate dummy variables with zero before the break year and 1 onward from the break year and only single break is taken given the short span of the data set (2002 to 2018). To take care of structural break and ensure dynamic stability of the model, the study follows similar empirical procedure from the work of Atchike *et al* (2020), Adamu and Danjuma (2021), thus, new series are introduced with the dummy variables and interaction terms, for control of corruption (ITCCRK) and access to electricity (ITAELC), CUSUM of Square bounds are used to validate stability and absence of break after the estimation with dummies and interaction terms.

Data Sources and Description of Variables

In order to have proper understanding of the variables used in the study, a description of each and their measurements are explain in table 2.

Table 2: Measurement of Variables and Sources

Variables	Measurement	Sources of Data
GDPC	Gross Domestic Product Per capita at constant US \$	World Bank Development Indicator (WDI) data base https://www.data.worldbank.org
AELC	Access to electricity in rate	World Bank Development Indicator (WDI) data base https://www.data.worldbank.org

CCRK	Control of corruption rank	The Worldwide Governance indicators (WGI) project. https://info.worldbank.org/governance/wgi/
-------------	----------------------------	---

Source: Author (2021).

ARDL Cointegration and Bounds Test

The framework for the estimation of the unrestricted ARDL model capturing both short run and long run parameter are presented below:

$$\Delta GDPC_t = \beta_0 + \sum_{i=0}^k \Delta \beta_1 GDPC_{t-i} + \sum_{i=1}^k \Delta \beta_2 CCRK_{t-i} + \sum_{i=1}^k \Delta \beta_3 AELC_{t-i} + \delta_1 GDPC_{t-1} + \delta_2 CCRK_{t-1} + \delta_3 AELC_{t-1} + \varepsilon_t \dots \dots \dots (3.1)$$

Where:

$\Delta GDPC_t$ is the first difference of the dependent variable GDPC, Δ is the change/difference sign, t-i are the lag periods, k is the maximum number of lags, β 's and δ 's are short run and long run parameters, ε_t is the error term.

A priori expectation of the parameters

The study based its expectations on the theoretical framework of greasers and sanders position, as such, corruption may have either positive or negative sign in relation to economic growth ($\beta CCRK > 0$ or $\beta CCRK < 0$) in Nigeria. Access to electricity is expected to boost economic activities and help in generating more output, thus, the expectation is $\beta AELC > 0$. The decision to accept/reject the parameters of the model in this study will be guided by the p-values (1%, 5% and 10%) of all the coefficients.

Post Estimation Diagnostics

After estimation of the long run estimates, the study applied diagnostic tests for reliability of the parameter estimates. The diagnostics applied are the serial correlation LM test, Heteroskedasticity test, REMSEY RESET (functional form/ linearity specification test), Jarque-Bera (Normality test), Cusum and Cusum of Square Stability test.

RESULTS AND DISCUSSIONS

Descriptive Statistics and Trends of the Variables

Table 3: Descriptive Statistics

Statistics	GDPC	CCRK	AELC
Mean	2176.465	11.21740	51.71820
Median	2294.150	11.99936	51.95236
Maximum	2580.007	19.81966	59.78437

Minimum	1556.594	-1.501062	43.23810
Std. Dev.	308.6531	4.477625	4.070751
Skewness	-0.444541	-0.633793	0.004491
Kurtosis	1.840895	3.535221	2.192973
Jarque-Bera	6.046305	5.364175	1.845559
Probability	0.048648	0.068420	0.397413
Observations	68	68	68

Source: Author's computation using E-views 10

The study used quarterly data point of sixty eight (68) observation as presented in table 3 above, with exception of GDPC, all other variables have are normally distributed with Jaque-Bera probability above 5%. The respective minimum and maximum values of GDPC are 1556.59 and 2580.00, that of CCRK are -1.50 and 19.82 and for AELC are 43.24 and 59.78. GDPC deviate from its mean of 2176.47 by 308.65, CCRK deviate from its mean of 11.22 by 4.48 and AELC deviate by 4.07 from its mean of 51.72. GDPC, CCRK and AELC ARE exhibit normal skewness within the range of zero which is desirable even though only AELC is positively skewed. Only CCRK has “leptokurtic with a value higher than the normal value of 3, which implies higher values above the mean” Adamu *et al* (2020)

Table 4: Correlation Matrix

Correlation	GDPC	CCRK	AELC
GDPC	1.000000		
CCRK	0.448127	1.000000	
AELC	0.758707	0.242657	1.000000

Source: Author's computation(2021) using E-View 10.

From the correlation matrix, the entire variables have positive correlation among themselves and none is up to 0.8 indicating absence of multicollinearity problem between the variables, although in the subsequent part of the work, Variance Inflation Factors (VIF) will be used for further checking of multicollinearity. However, the correlation have short-coming of incapability of explaining the extent to which a unit change in an independent variable affects the dependent variable of interest, thus, regression analysis is further required.

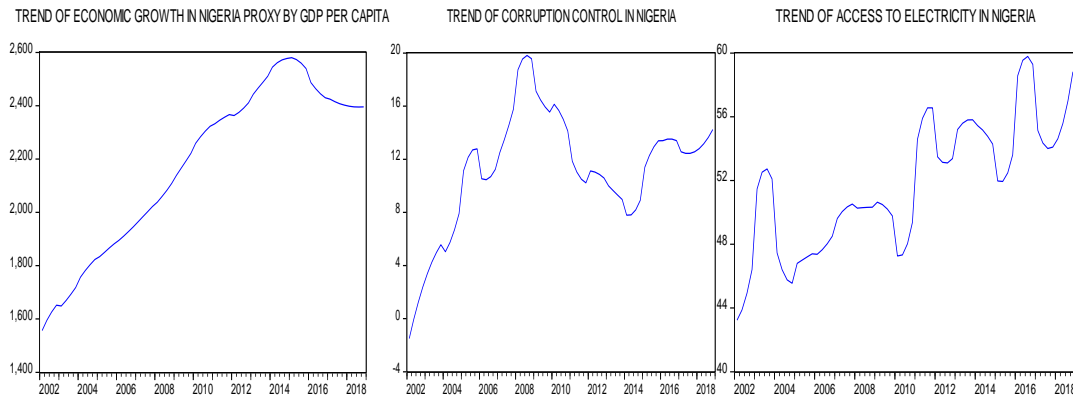


Fig.2. Trends of the Variables.

It is observed from figure 2 above, that economic growth, control of corruption and access to electricity fluctuate, but continues to exhibit positive trend, these trends posed questions as to the nature of the nature of nexus of control of corruption and access to electricity in influencing economic growth in Nigeria.

Table 5: Result of Unit Root Test for All the Variables

Variables		ADF TEST		PP TEST	
At	Level	Intercept	Linear Trend	Intercept	Linear Trend
	I(0)				
	GDPC	-1.7085(0.4223)	-0.7529(0.9643)	-2.6532(0.0877) ^c	0.5296(0.9992)
	CCRK	-2.6110(0.0966) ^c	-2.5922(0.2853)	-2.8625(0.0552) ^c	-2.4507(0.3510)
	AELC	-0.0097(0.9535)	-3.6044(0.0383) ^b	-2.2213(0.2008)	-3.5640(0.0408) ^b
At	1 st diff.	Intercept	Linear Trend	Intercept	Linear Trend
	I(1)				
	GDPC	-2.6177(0.0946) ^c	-	-2.5968(0.0987) ^c	-3.2435(0.085) ^c
	CCRK	-1.7566(0.3980)	-1.5272(0.8087)	-4.3365(0.0009) ^a	-
	AELC	-	-	-	-

Source: Author’s Estimation (2021) using E-views software version 10. Notes: (c) Significant at the 10%; (b) Significant at the 5%; (a) Significant at the 1%. Via MacKinnon (1996) one-sided p-values.

The unit root test result from table 5 gives mixed order of integration (I(0) and I(1)), which is level and first difference stationarity series. Going by ADF results, GDPC and CCRK are only stationery at 10% significance level which is weak relative to 5% and 1%. The study suspect the stationarity levels of the

series may be due to the presence of structural break caused by regime and policy changes, given the political regime change in Nigeria into the hands of new political party after 16 years the Peoples Democratic Party (PDP) led regime was defeated by All Progressive Congress (APC) in 2015, policy directions on handling corruption cases, power supply and in general economic progress in the country are bound to change. However, the traditional unit root tests (ADF and PP) above lack the capacity to capture such structural changes, ADF and PP may even take break as a unit root, as such, Zivot- Andrew structural break point unit root test is employed to supplement the ADF and PP tests and avoid the consequences of not accounting for the structural break in the system.

Unit Root Tests Results: The Zivot-Andrew Unit root test

Modeling a non spurious regression requires the use of stationery series. The results of Zivot-Andrew unit root test (Zivot & Andrew, 1992) applied is to unveil structural break in the variables if any and the outcome are presented in the table 5.

Table 6: Zivot-Andrews Break point unit root results

Variables	Zivot-Andrews		Break Point Period	Order of Integration
	At Level I(0)	Intercept		
GDPC	-3.357(0.002) ^a	-	2015Q3	I(0)
CCRK	-4.053(0.000) ^a	-	2020Q2	I(0)
AELC	-3.930(0.006) ^a	-	2011Q1	I(0)

Source: Author's Estimation (2021) using E-views software version 10. Notes: (a) Significant at the 1%. Probability values in parenthesis are calculated from a standard t-distribution and do not take into account the breakpoint selection process

Table 7: Maximum Lag Selection Criteria

VAR Lag Order Selection Criteria						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-758.2937	NA	6289738.	24.16805	24.27011	24.20819
1	-442.0655	592.3003	365.6443	14.41478	14.82300	14.57533
2	-383.2608	104.5417	75.40015	12.83368	13.54805*	13.11464
3	-376.1092	12.03295	80.38636	12.89235	13.91289	13.29374
4	-371.3540	7.547854	92.89928	13.02711	14.35381	13.54891

5	-330.7762	60.54472*	34.64315*	12.02464*	13.65750	12.66685*
---	-----------	-----------	-----------	-----------	----------	-----------

Source: Author's computation(2021) using E-Views 10.

Relying with the Akaike Information Criteria (AIC), the maximum lag that can be selected while modeling the relationship in this study is five (5).

Cointegration test

Result of Cointegration Tests

Pesaran, Shin, & Smith (2001) bounds test for co-integration is used due to its power to handle both level and first difference stationery series, and selected lag of four used is within the optimum guided lag by Akaike information criteria (AIC), which is necessary step before cointegration test (Akaike,1974).

$$\beta GDPC = \beta CCRK = \beta AELC = 0$$

The alternative hypothesis of co-integration among variables is

$$\beta GDPC \neq \beta CCRK \neq \beta AELC \neq 0$$

Table 8. Bounds test Co-integration result

Test Statistic	Value	Signif.	Lower Bounds I(0)	Upper Bounds I(1)
F-statistic	5.767859	10%	2.209	3.201
K	5	5%	2.596	3.677
		1%	3.43	4.721 ^a
n = 64				

Source : Author's via E-views 10. The superscripts ^a,and ^b are the 1% and 5% significance levels

From table 8, The ARDL f-statistics of 5.768 is greater than all the upper bounds indicating the existence of cointegration or long run relationship among the series.

Table 9. Chow Breakpoint Tests Results indicates 2015 break for the independent variable GDPC

Chow Breakpoint Test: 2015Q1

F-statistic	7.622156	Prob. F(3,62)	0.0002
Log likelihood ratio	21.34824	Prob. Chi-Square(3)	0.0001
Wald Statistic	22.86647	Prob. Chi-Square(3)	0.0000

Source : Author's computation(2021) using E-Views 10.

The Chow Null hypothesis of no break is rejected with significant f-statistic probability value at 1%. The result from chow break point test revealed the presence of structural break in year 2015 first quarter, which coincided with the period of regime change in the country. This result further confirmed or yielded the answer to absence of dynamic stability observed in the ARDL model estimated before accounting for structural break.

Table 10. Short-Run Ardl Estimates

Variable	Coefficient	Prob.
Dependent Variable: D(GDPC)		
D(GDPC(-1))	0.459596	0.0000 ^a
D(CCRK)	-2.389928	0.0040 ^a
D(AELC)	-1.270975	0.0390 ^b
D(AELC(-1))	0.375940	0.5796
D(ITCCRK)	25.51277	0.0000 ^a
D(ITAELC)	-3.774549	0.0001 ^a
ECM	-0.026322	0.0000 ^a
R	0.890642	
R ²	0.874735	
Durbin-Watson stat	1.991139	

Source : Author's via E-views 10. The superscripts ^a and ^b are the 1% and 5% significance levels.

In the short run, control of corruption and electricity access have significant negative impacts on economic growth, 1 unit increase in control of corruption in the short run in Nigeria brings about a decrease in economic growth of the country by 2.39 units at 1% level of statistical significance. However the interaction of corruption control proved to increase economic growth even in the short-run. Similar negative relationship of impact exist between access to electricity and economic growth in the short run at 5% level of significance,

with access to electricity bringing 1.27 decreases in economic growth in the short run period.

The interacting role of corruption is positive to economic growth while it is negative for access to electricity all of which are statistically significant. The Error Correction Mechanism (ECM) or the speed of adjustment to long run equilibrium in the event of distortion in the system is at 2.63% quarterly or 10.52% annually for restoration back to equilibrium with correct statistically significant negative sign at 1% significance level. All other things remain constant, with the 10.52% annual speed, from 2018, it will take nine years and five months ($1/10.52 = 9.5$) for Nigeria to realized the needed economic growth after the negative effects of corruption on the economy if the fight against corruption is maintained or less duration is if fight against corruption is intensified beyond current level. Furthermore, Previous year's economic growth also help in increasing economic growth in Nigeria, going by the positive and significant lagged GDPC value.

Table 11. Long Run ARDL and DOLS Estimates

ARDL			DOLS	
Variable	Coefficient	Probability	Coefficient	Probability
CCRK	26.35141	0.0044 ^a	19.03250	0.0046 ^a
AELC	74.66073	0.0000 ^a	70.37318	0.0000 ^a
DUGDPC	-3665.935	0.1302	4589.341	0.1108
ITCCRK	34.78254	0.8581	-34.28212	0.9589
ITAELC	43.47937	0.4530	-75.66801	0.6141
GDPC(-1)	-0.026322	0.0007 ^a	-	-
CCRK(-1)	0.693617	0.0123 ^b	-	-
AELC(-1)	1.965205	0.0068 ^a	-	-
C	-1549.260		-1658.483	
R ²	0.890642		0.881254	
Adj. R ²	0.874735		0.827279	

Source : Author's via E-views 10. The superscripts ^a, and ^b are the 1% and 5% significance levels

The long run coefficient results of both ARDL and DOLS revealed positive impacts of control of corruption and access to electricity in Nigeria. ARDL estimates showed that a unit increase in control of corruption and access to electricity brings about 26.35 and 74.66 increase in economic growth respectively. Similarly, DOLS estimate revealed that a unit increase in control of corruption and increase in electricity access in Nigeria bring about respective 19.03 and 70.37 units increases in long run economic growth in Nigeria, the positive effect of corruption control on economic growth is in conformity with the work of Sharma and Mitra (2019) and electricity having positive effect on economic growth had also been validated by the work of Nathaniel and Bekun (2021). The R^2 and adjusted R^2 indicated that the model has the power explaining more than 80% of the variation in Nigeria's economic growth, to further evaluate the reliability of the model; post estimation diagnostics test is applied.

Table 12: Results of the Post estimation Diagnostics Test

Test	F-Version	LM/t- Version*	Conclusion
Serial correlation: Breusch-Godfrey LM Test	283(0.754)	0.764(0.683)	No serial correlation
Heteroskedasticity: Breusch-Pagan- Godfrey	0.475(0.936)	7.641(0.907)	Homoscedastic residuals
Functional form : REMSEY RESET	0.588(0.447)	0.767(0.447)*	Correct functional form or correct specification of the model
Stability : CUSUM, CUSUM OF SQR	within 5% bounds fig 3.		Both are Stable

Source: Author's estimation (2021) using E-views software version 10. Note that: Values in (p-value).

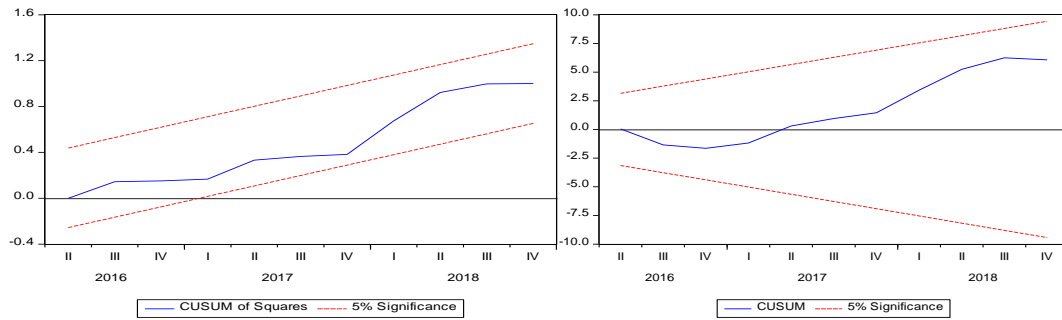


Fig 3: Cusum of Square and CUSUM Stability Bounds

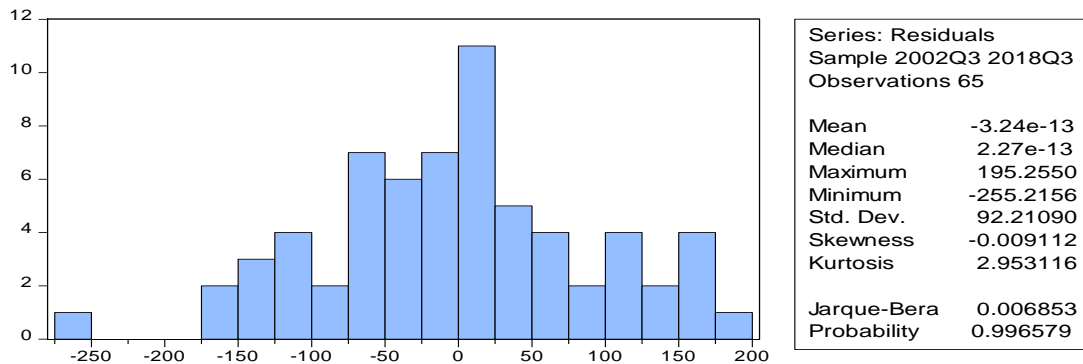


Fig 4: Jaque-Bera Normality Result (from DOLS)

Deducing from: Table 12 (Results of the Post estimation Diagnostics Test), fig. 3 and 4, showed that the model is reliable after accounting for structural break as it is having dynamic stability (see, fig. 3), serial independence, homoscedastic residuals, and correct specification or functional form. The Jaque-Bera normality probability value is 0.996 which is significantly greater than 5%, indicating residuals are normally distributed. Variance Inflation Factors (VIF) for the independent variable were 1.03 for control of corruption and 1.83 for access to electricity, this means no multicollinearity as the values are less than 10 going by rule of thumb.

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

This study is on Analysis of the effects of corruption and electricity access on economic growth in Nigeria, from 2002Q1 to 2018Q4. ADF, PP and Zivot-Andrews break point unit roots test were applied and the results revealed none of the series is integrated of order two (2), thus, paving way for applying ARDL and DOLS models in this study. Structural break is identified by Chow test and

taken care of by introduction of dummy variables and interaction terms which was verified to be reliable by Cusum of Square stability test.

Short ARDL empirical results indicated that control of corruption brings about decrease in economic growth in Nigeria, this obvious as those benefiting from corruption may do all they can to see that control of corruption failed in Nigeria, but the interacting role of corruption control with economic growth is positive, meaning as the country allow room for corruption control, it will give positive result to economic growth. Similar negative relationship was found for access to electricity and economic growth in the short run, this finding is an indication that in the short run productive sectors may not rely much on electricity access from the national grid in the short run period thereby halting the supposed economic progress in Nigeria.

The long run empirical estimates from both ARDL and DOLS indicated that control of corruption and increases in electricity access have significant positive effects on economic growth in Nigeria, meaning, after the short run problems that corruption and electricity access posed on economic growth, in the long run increase in corruption control and access to electricity brings huge economic prosperity. But *ceteris paribus*, it will take time to reach such level as the speed of adjustment (ECM) to long-run equilibrium just 2.63%

Going by the empirical results and trends of various indicators presented in this study, it is recommended that government should continue to pursue the control of corruption as it will result in long run economic growth of the country, convicted corrupt persons and organization should be legally penalized severely to serve as deterrence for would-be offenders. Similarly, both public and private individuals should be given more electricity access as it has the capacity to boost productive activities and thereby increasing economic growth in the long-run, developed countries and even some developing countries have higher electricity access and GDP per capita than Nigeria, as such, for Nigeria to be in their ranks, electricity access should be improved in Nigeria. Future studies should include other good governance indicators and other energy consumption variables by applying same or different econometric techniques based on the nature of the data before the future studies.

REFERENCES

Adamu, S. and Danjuma, M. (2021). Investigation of the nexus among Unemployment, Inflation, Transport and Electric Energy Consumption In Nigeria. *Federal University*

- Wukari Journal of Economics, Management & Social Science (FUWJEMSS), Volume 7 No.1: 61-79.
- Adegboyega, R. (2017). Corruption and Economic Growth in Nigeria: A Cointegration (FM-OLS), *Approach Annals of the University of Petroșani, Economics*, 17(1), 5-18.
- Akaike, H. (1974). A new look at the statistical model identification. *IEEE transactions on automatic control*, 19(6), 716-723.
- Ben, E. U., Udo, E. S., Abner, I. P., Ibekwe, U. J. (2018). The effect of corruption on economic sustainability and growth in Nigeria. *Internal Journal of Economics, Commerce and Management*, Vol. VI, Issue 4.
- De Graaf, G. (2003). Causes of corruption: towards a contextual theory of corruption. Available at: <http://unpan1.un.org/intradoc/groups/public/documents/undpadm/unpan049603.pdf>.
- EFCC (2005) Effect of corruption on Nigeria's economy. Nigeria EFCC Information Communication Technology Department. Abuja, 2005.
- Erum, N. and Hussain, S. (2019). Corruption, natural resources and economic growth: Evidence from OIC countries. *Resources Policy* 63 (2019) 101429. <https://doi.org/10.1016/j.resourpol.2019.101429>
- Ghulam Shabbir (2017). Corruption, Democracy And Economic Growth: Does Conditionality Matter? *Pakistan Economic and Social Review* Volume 55, No. 1(Summer2017), pp. 99-117
- Huberts, L., Kaptein M, & Lasthuizen, K. (2004). Leadership and integrity violations at work: A study on the perceived impact of leadership behaviour on integrity violations within the Dutch Police Force. Paper presented at IRSPM VIII, Budapest.
- Huntington SP. 1968. Political order in changing societies. In New Heaven. Yale University Press.
- ICPC. Nigeria and Corruption. Independent Corrupt Practices and other related offences Commission, 2006.
- Ighodaro, C., & Igbinedion, S. (2020). Corruption and Economic Growth in West Africa. *JEJAK: Jurnal Ekonomi dan Kebijakan*, 13(2), 265-279. doi:<https://doi.org/10.15294/jejak.v13i2.24228>
- Igiebor, G. O. (2019). Political Corruption in Nigeria: Implications for Economic Development in the Fourth Republic. *Journal of Developing Societies* 35, 4 (2019):493-513. DOI: 10.1177/0169796X19890745.
- Iyke, B. N. (2015). Electricity consumption and economic growth in Nigeria : A revisit of energy growth-debate, *Energy Economics* 51, 166-176.
- Iyoha, F.O., Gberebie, D.F., Iruonagbe, C.T., Egharevba, M.E. (2015). Cost of governance in Nigeria: in whose interest? *International Journal of Social, Education, Economics and Management Engineering*, 9(1)
- Jackall, R. (1988). Moral mazes: The world of corporate managers. New York: Oxford University Press.
- Klitgaard, R. (1988). Controlling corruption. Berkeley: University of California Press.
- Leff NH. 1964. Economic development through bureaucratic corruption. *American Behavioral Scientist*, 8 (3), 8-14.
- Mauro, P. (1998). Corruption and the composition of government expenditure. *Journal of Public Economics*. 69, 263-279.
- Mendoza RU, Lim RA, Lopez AO. 2015. Grease or sand in the wheels of commerce? Firm level evidence on corruption and SMEs *Journal of International Development* 27 (4): 415-439.

- Morris, S.D.(1991) Corruption and Politics in Contemporary Mexico, University of Alabama, Press, Tuscaloosa.
- Natalia (2016). Corruption Perception Index. <https://www.britannica.com>
- Nathaniel, S.P. and Bekun, F. V. (2021). Electricity Consumption, Urbanization, and Economic Growth in Nigeria : New insight from combined cointegration amidst structural breaks. *Journal of Public Affairs* 21 (1), e2102.
- Ngutsav, A.S. (2018). Corruption, Government Expenditure and Economic Growth in Nigeria. *Lafia Journal of Economics and Management Sciences Volume 3 Number 1*
- Ogundipe, A. A. and Apata, A (2013). Electricity Consumption and Economic Growth in Nigeria. *Journal of Business Management and Applied Economics*, 11(4).
- Olufemi, O.J. (2015). The Effects of Electricity Consumption on Industrial Growth in Nigeria. *Energy*, 6(13), 54-59.
- Omodero, O. C. & Dandago, K. I. (2018). "Corruption and Stock Market Performance in Nigeria." *Annals of Spiru Haret University. Economic Series*, 18(4), 23-40, doi: <https://doi.org/10.26458/1842>
- Phillips, P.C. and Perron, P.(1988).Testing for a unit root in time series regression.*Biometrika*,75,335-346.<https://doi.org/10.1093/biomet/75.2.335>
- Punch, M. (2000). Police corruption and its prevention". *European journal on criminal policy and research*. 8, 301-324.
- Qureshi, F., Qureshi, S., Vo, X. V., and Junejo, I. (2020). Revisiting the nexus among foreign direct investment, corruption and growth in developing and developed markets, *Borsa Istanbul Review*, <https://doi.org/10.1016/j.bir.2020.08.001>
- Rose-Ackerman, S. (1978). Corruption: A study in political economy. New York: Academic Press.
- Rotini, E. M., Obasaju, B., Lawal, A. D. and Ise, O. J. (2013). Analysis of Corruption and Economic Growth in Nigeria. *Afro Asian Journal of Social Sciences*, 4(4.2): 1-19
- Sharma, C. and Mitra, A. (2019). Corruption and Economic Growth: Some New Empirical Evidence from a Global Sample. *Journal of International Development*, DOI: 10.1002/jid.3433
- Svensson, J. (2005). Eight questions about corruption, *Journal of economic perspectives*, 19(3), 19–42.
- Teveik, F. N., Albert, C. P., & Charles, S. (1986). A policy-oriented theory of corruption. *American Political science review*, University of Michigan Flint, USA.
- Todaro, M.P.; Smith, S.C. (2003) Economic Development, Pearson Education (Singapore) Pte, Ltd.
- Transparency International (2011). Corruption Perception Index. <https://www.transparency.org> .
- World Bank (1997) Helping countries combat corruption: the role of the World