

Democracy and Economic Growth in Nigeria: Implications for the Environmental Kuznets Curve

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Abstract— This paper seeks to contribute to existing debates on the relationship between democracy and environmental quality by using the Environmental Kuznets Curve analysis approach to investigate the case of Nigeria. The econometric tests resorted to were group unit root tests and Engle-Granger co-integration test. The Conical Co-integration Regression technique was used to estimate the co-integration equation for time span of 1980 to 2018. Finding indicates no existence of EKC hypothesis in Nigeria because of statistical insignificance of the coefficients of GDP per capita and GDP per capita squares at any conventional level of 1%, 5%, or 10%. Rather, improvement of democracy contributes to reduction of carbon dioxide emissions per capita (environmental degradation). Gross domestic investment has a negative and significant effect on carbon dioxide emissions per capita (environmental degradation) but income inequality worsens environmental degradation in Nigeria. In order to maintain and improve the existing level of environmental quality in Nigeria, roadblocks to a strong democracy in Nigeria at all levels of government should be removed. Likewise, environmental laws and policies targeted at ameliorating environmental degradation situation in Nigeria should be effectively enforced.

Keywords—Conical Cointegration Regression (CCR), Democracy, Environmental Kuznet Curve, Economic Growth, Income Enequality

I. INTRODUCTION

In the technical language of economics, a public good is a non-rival and non-excludable resource. In that context, environmental quality is a typical illustration of a non-excludable or 'public' good. Consequently, the costs of degeneration are braved by society instead of just the polluter (or simply put, the blessings of environmental quality emanate to majority if not the entirely citizens) [1]. Economists as well as policy-makers are seriously interested in the link between national income and environment quality. So also is the public at large. This engrossment is cast back by heighten antagonism between global environmental concerns and global economic development policy, as shown by incessant rebellions at WTO meetings. Early literature on this nexus paid serious attention on the so-called Environmental Kuznets Curve (EKC), which hypothesizes an inverted-U shape when pollution measures are plotted against income per capita.

However, the connection between environmental quality and economic development is not established in separation from political institutions that oversee the procedure of policymaking in a specific country. Consequently, by way of illustration, Dasgupta and Mäler appropriately highlight in [2]: "Environmental protection and civil and political rights

link is an intimate. As a common rule, political and civil liberties are influentially dominant in protecting the environmental resource-base, at least in comparison to the non-existence of such freedom in countries governed by authoritarian rule".

An additional rationale that democracy is contended to boost environmental quality is that it allocates extra public goods than autocracy does [3], [4]. While governments of all categories may supply public goods, governments are inclined to do so by stabilizing the costs and benefits that are politically pertinent. In democracies, the dominating group is the whole citizenry, and political balancing equates marginal cost and marginal welfare to the median citizen.

In view of the fact that the bulk of contemporary environmental predicaments emanate as a negative by-product of heighten demands placed on the natural environment by human aggregate and wealth, democracy may be regarded in the whole as representing an effectual social feedback mechanism. Owing to the fact that administering of resources is more vigorous in the autocracy, the elite group can be anticipated to carry an unreasonably substantial fraction of public goods costs to benefits. Accordingly, autocracies will typically champion negligible environmental protection goods. Even though environmental

protection benefits are normal or superior goods- in higher demand as income grows- an elite group is likely to relish at best an inconsequential portion of economy-wide gains from enlarged provision [5]. [6] and [7] emphasized a salient capability of democratic countries to meet people's environmental preferences and their readiness to commit themselves to international negotiations and agreements.

There is no clear-cut stand regarding results from empirical studies. At first, it may be established that democracy is positively associated with environmental obligation, but this is not certainly the case with environmental outcomes [8]. As posited by [9], democracy does not safeguard the environment. In fact, democracy is one of economic growth and prosperity factors which could have a negative influence on the environment. Democratic countries, according to the findings of [10] ameliorate land quality and natural resources.

In consideration of the fact that democratic governments hold in high esteem the preferences of majority over minority, democratic countries have the prospective to ameliorate land condition and natural resources profiting the majority. In the same vein, [11], and [12] revealed that democratic governments ameliorate water condition. [13] revealed that a boost in democracy lessens CO₂ emissions per capita for a sample of 108 countries in 1990. [14] discovered that democratic governments aggravate global air quality by intensifying CO₂ emissions per capita. Inasmuch as democratic countries possess local attributes and naturally centre on environmental quality inside the boundary of their countries, democratic governments could exacerbate global air quality between countries. It is all right to state that the empirical evidence is mixed. Equally, a good deal of the empirical studies cited here did not control for the Kuznets curve effect.

In the light of the foregoing, this paper empirically evaluates the EKC relationship in Nigeria and considers it in conjunction with the hypothesis that democracy may improve environmental quality. The country returned to democratic rule in 1999, after thirty-three years of predominately military rule. In a nutshell, after obtaining independence in 1960 from Great Britain, Nigeria fell prey to civil war and the first of numerous military coups in 1966. Democracy was shortly reinstated from 1979 to 1983 to the country, but for almost all its independent history, Nigeria was governed by a succession of military juntas. The last major military ruler, Gen. Sani Abacha, died abruptly in 1998. His successor, Gen. Abdulsalami Abubakar guaranteed a transition to democracy, and on that account a new constitution was ratified on May 5th, 1999. Elections were conducted and retired Gen. Olusegun Obasanjo, who had in the past ruled Nigeria as a military governor, was elected the new president.

The termination of military rule instituted a brand new epoch of routine elections as well as the return of civil liberties, free press and an end to unjustifiable apprehension and persecution, notwithstanding that human rights infringement nonetheless happen recurrently. Nigeria furthermore initiated an extensive campaign against the bureaucratic and military corruption that had incapacitated its economy and gravely tainted its international reputation.

The country's economy has experienced a resound forasmuch as the return of civilian rule. Nigeria's gross domestic product (GDP) has expanded six-fold since 1999, as depicted by World Bank data. In 1999, regardless of its huge oil wealth, Nigeria's GDP was just \$59bn. That amount catapulted to \$375bn by the end of 2017. Nigeria, Africa's utmost densely populated country, is nevertheless exceedingly dependent on oil. Petroleum constitutes beyond 80 percent of total export revenue, as stated by the Organization of the Petroleum Exporting Countries (OPEC). Nigeria's economy was not spared in 2016 when the global oil price collapsed. The country encountered a recession, its first in 25 years. The country's economy which is the largest on the continent ahead of South Africa, has not completely recovered. Unemployment stands at 23 percent and inflation at 11 percent, according to official figures. To achieve the objective of the study the paper is organized in five sections. Following this introduction is Section 2 which gives an overview of environmental quality and democracy in Nigeria. Section 3 shows the materials and methods employed in the paper. It presents the econometric model used to investigate the EKC relationship in Nigeria and role of democracy. Section 4 provides analysis of the result while Section 5 summarizes and concludes the paper with some recommendations.

II. ENVIRONMENTAL QUALITY AND DEMOCRACY IN NIGERIA: OVERVIEW

A. *Environmental Quality in Nigeria*

Nigeria is located in western Africa on the Gulf of Guinea and has a total area of 923,768 km² (356,669 sq mi) [15], making it the world's 32nd-largest country (after Tanzania). It is comparable in size to Venezuela, and is about twice the size of California. It shares a 4,047 kilometres (2,515 mi) border with Benin (773 km), Niger (1497 km), Chad (87 km), Cameroon (1690 km), and has a coastline of at least 853 km [15]. Nigeria lies between latitudes 4° and 14°N, and longitudes 2° and 15°E [16].

Chappal Waddi is the highest point in Nigeria and stands at 2,419 m (7,936 ft) [17]. River Niger and Benue River are the foremost rivers, and they intersect and unload into the Niger Delta, which happens to be one of the world's largest river deltas and the scene of immense area of Central African

Mangroves. Additionally, Nigeria is a cardinal biodiversity centre. Generally, it is maintained that the areas surrounding Calabar, Cross River State, is habitat to the world's greatest diversity of butterflies. In the wild of the Southeast Nigeria as well as neighbouring Cameroon is where the drill monkeys are found [17].

The landscape of Nigeria is diverse. The tropical rainforest climate defines the far south and annual rainfall experience there is 60 to 80 inches (1,524 to 2,032 mm) a year [18]. The Obudu Plateau stands out in the southeast. Equally, in both the southwest and the southeast, coastal plains exist. This forest zone's most southerly segment is defined as salt water swamp, better known as a mangrove swamp as a result of the immense of mangroves in the area. North of this is fresh water swamp, accommodating divergent vegetation from the salt water swamp, and north of that is rain forest [19].

Nigeria's most extensive topographical region is that of the valleys of the Niger and Benue River valleys (which merge into each other and form a "y" shape). There exist a "rugged" highland to the southwest of the Niger and to the southeast of the Benue are hills and mountains which forms the Mambilla Plateau. This Plateau happens to be the highest Plateau in Nigeria and expands to the border with Cameroon. This montane land is part of the Bamenda Highlands in Cameroon. Rich rainforest is situated in the area near the border with Cameroon close to the coast and portion of the Cross-Sanaga-Bioko coastal forests eco-region which is a very significant centre for biodiversity including the drill monkey which is only found in the wild in this area and across the border in Cameroon. Generally, the belief is that the areas surrounding Calabar in Cross River State which is also in this forest, contain the world's largest diversity of butterflies. Unfortunately, in the area of southern Nigeria between the Niger and the Cross Rivers, grassland has replaced the forest over time [17].

The entirety in-between the far south and the far north, is savannah (tree cover of little importance, with grasses and flowers located between trees). In addition, rainfall is about 20 and 60 inches (508 and 1,524 mm) annually [18]. The three classification of savannah zones are Guinean forest-Savanna mosaic, plains of tall grass which are disrupted by trees and the most common across the country: Sudan savannah, almost identical, but with "shorter grasses and shorter trees; and Sahel savannah, consist of patches of grass and sand, found in the northeast [19]. Furthermore, to the north is the Sahel with its almost desert-like climate. The rainfall experienced there is below 20 inches (508 mm) annually and the Sahara Desert is intruding [18]. Lake Chad is located in the dry north-east corner of the country. This lake is shared by Nigeria, Niger, Chad and Cameroon. Nonetheless, notwithstanding every single one of these magnificent records about Nigeria's natural environment, the

nation's natural environment is overwhelmingly afflicted by various prevailing environmental challenges encountered in several nations. Three of Nigeria's environmental issues, which are desertification, deforestation, and pollution, share negative effects in connection with the rehabilitation of Nigeria's natural environment.

Desertification has on all occasions persisted to be a worrisome issue in Nigeria. Desertification can be seen as an environmental condition where ruined, used, or resource loss lands are gradually modifying into deserts. Clearly, their insufficiency of resources has resulted in distressing issues, where desertification has taken an enormous effect to the point of issuing basic necessities. Undoubtedly, this is instrumental in the desertification of certain areas owing to the fact that human population would consistently decline in these areas. Sand dunes moreover play a principal position, where several areas in Nigeria would have above 50,000 hectares [20]. These huge areas of barren wasteland would lead to utmost heat, resulting in adverse conditions for humans to live in and thus absence of human settlement. Human activity such as wood extraction in fuel and construction, bush burning, grazing, cultivation, irrigation management, and poverty contributed to poorly managed lands, resulting in resource loss and serious economic impacts. Because resource loss had been met, factors that include bio diversity loss and destruction of habitat have led to destroyed lands. A greatly affected area is the northern side of Nigeria, where Lake Chad has lost about 21,000 square kilometres in water attributable to influences such as droughts [21]. Water loss here has contributed to desertification generally, giving rise to habitat loss and migration of human activity.

One more example of obvious challenge is deforestation, where habitat loss and clearing of lands have led to arid and dry lands. It was recorded in 1975 that about one third of the country had included forests and some form of vegetation. Timbers had turned into a trivial resource to utilize in fuels and construction, but its increasing harvesting brought about data predictions that in less than 15 years, these resources would be entirely utilized [21]. Deforestation as a process is clearing a land of its natural forestation and vegetation in order to replace it with another type of land or structure, abating the possibility of restoring its natural environment. Urban and industrial growth concerning production has generated enormous pressure on Nigeria's forestation. FAO estimated that Nigerians destroy about 600,000 hectares of Nigeria's forests annually via human activity and expansion [21]. The resultant effect might be permanent deforestation for majority of Nigeria's present vegetation.

Pollution can be regarded as an extra environmental threat to Nigeria, primarily wasted resources such as oil, water, and air. Oil spills, blow-outs, and ballast release have seriously

emanating in wildlife loss for Nigeria, where its additional loss of natural resource has even distressed the economy [22]. This human activity has over and above that cause decline in biota and fishery succession. Dangerous chemicals such as gases and tins have affected lands to become even more heated, complicating global warming issues [22]. A further circumstance is air and water pollution, where chemicals escaped both into the air and water partly responsible for development of carbon monoxide, a grievous issue for living organisms. The World Health Organization had reported that aquatic pollution is instrumental in diseases and illness for humans, while airs like carbon monoxide are being produced by industries and urbanization [21]. This in turn had generated to a drop in Nigeria's general economic system and human population.

B. Democracy in Nigeria and Environmental Protection: Overview

Shortly after independence in 1960 (that year Nigerians became the citizens of the 4th biggest democratic country in the world), the first military coup happened in 1966. The new civil war broke in 1967 and lasted till 1970. However, democratic model was restored for a number of years starting 1978. Before long, the period was over in 1983. Most of the time in its 'young' history, Nigeria was a country with military coups. Several rulers promised to return to democracy, however, only General Abdulsalami Abubakar who took the power after the death of Sani Abacha kept his word. In 1999, the country's modern Constitution became official

The elections of 1999 were successful compared to the previous military ruler. The new President Olusegun Obasanjo put the end to the military regimes that kept changing one after the other for almost 30 years. In May 2007, Alhaji Umaru Yar'Adua was sworn in as President of the Federal Republic of Nigeria, the 13th head of state of Nigeria. Yar'Adua died on 5 May 2010 in the Presidential villa, in Abuja, Nigeria. On 6 May 2010, the Vice President Goodluck Jonathan was sworn in as President of the Federal Republic of Nigeria and the 14th head of state. On 29 May 2015, Muhammadu Buhari was sworn in as President of the Federal Republic of Nigeria and the 15th head of state after winning the general election.

Annually, Nigeria's democracy is commemorated. Nevertheless, the country still has multiple issues to repress. For instance, the voice of the people is not being considered in the choices of their elected officials. Instead of asking how a policy might help Nigerians, officials ask how it would win them the next elections – how it would enhance campaign donors and party godfathers and how much it would generate for the election war chest. This perpetual campaign culture is a costly drawback of the kind of American style democracy that was forced on Nigerians. The difference is that

America's robust economy can absorb the cost; Nigeria's cannot.

Under Nigeria's democracy, guarantee of basic human rights and freedom of the press, the right to free political choice, and the right to make deliberative input in governance have all been refused Nigerians in one form or the other. In its democracy, equality before the law is non-existence. There are several instances where public officials who have perpetrated unlawful act are handled differently, either because they belong to the ruling party, or because they are 'traditional rulers', or because they have people who can beg for them.

The rule of law is blatantly ignored. Court orders are resisted by the government when they do not agree with the orders and enforced when such orders are favourable to them. An example is the continuous detention of Sambo Dasuki, former NSA, despite numerous courts granting him bail, but same government ran to the courts to stop the NLC's planned strike.

One of the greatest challenges facing Nigerian democracy is weak institutions. Political parties which are one of the institutions are weak because they do not practice internal democracy. The situation had made the political parties not to have the belief, values and practice that would contribute to building democracy in the country. The Independent National Electoral Commission (INEC) recently declared that at least 18 of the registered political parties in Nigeria are operating with invalid national executive committees whose tenures had expired. Virtually all parties have very little respect for internal democracy; that is to say that they do not conduct their internal affairs based on the principles enunciated in their constitutions and rules. More so, party officials and candidates for elections are not elected in accordance with the rules of the game and party conventions become occasions in which governors and godfathers simply impose candidates.

Other problems in Nigeria include; poor educational system, high rate of unemployment, increase crime, underdevelopment of human resources, changes of administrative policies, corruption leaders, poor infrastructure, high rate of inflation, Boko Haram and terrorism, and gender issues.

According to [23], the Report of the Vision 2020 Committee set up to prepare a blueprint that will spur Nigeria among the top 20 world economies by 2020 acknowledged that Nigeria is faced with several environmental issues such as the continuous exploitation of marginal lands, drought and desertification in the north, severe gully erosion in eastern and northern states, unrestrained logging with inherent problems of the destruction of bio-diversity, unsuitable

agricultural practices, devastation of watershed, devastation of vast agricultural lands, generating of burrow pits owing to bad mining practices and road works, oil pollution from spillage and gas flaring, urban decay and squatter settlements, industrial pollution and municipal waste generation, climate change and ozone depletion among others.

There has been a resuscitated interest in environmental management and protection since the return of democracy to Nigeria in 1998. This came to a climax by the establishment of the Federal Ministry of Environment and State Ministries of Environment at the state levels in 1999. The Federal Ministry of Environment is the apex policy organ for all environmental policies in Nigeria. It makes sure that all Local, States and Federal agencies along with organizations that operate in Nigeria, act in accordance with all regulations. The regulations that govern diverse human activities on the environment are bestowed on several agencies under the ministry [24]. The main agencies for the implementation of environmental regulations are the National Environmental Standards and Regulations Enforcement Agency (NESREA), which was established in 2007 to substitute FEPA; and the National Oil Spill Detection and Response Agency (NOSDRA) established in 2009 as a reaction to increased disconcertment to restore and put an end to the environmental damage of oil production in the Niger Delta [25].

Nigeria is one of the principal African countries that have signed nearly all the international protocols on environment in an attempt to have a sustainable environment, but at the grassroots much still remains to be done. Attempts to domesticate almost all the protocols have remained a big issue to not just Nigeria but other African countries. As the need for the government and people to do something positive for the environment becomes ever more compelling, the need to spur individual efforts into a collective power that impacts positively on the planet earth is equally inevitable.

The present government of Muhammadu Buhari who came into power On 29 May 2015, has taken positive steps in indicating interest and taking some steps in the fight against environmental degradation in order to attain a sustainable environment. This is essential so as to keep away from depletion or degradation of natural resources and enabling long-term environmental quality that circumscribes renewable resource harvest, pollution curtailment and establishing a green economy. With the notable signing of the Paris Agreement by President Muhammadu Buhari, Nigeria has been at the front line as an African country that is prompt in signing international protocols and promising a lot in terms of sustaining a healthy environment.

III. MATERIALS AND METHODS

A. Model Specification

The specification of model in this paper considers standard EKC model following [26] which takes the following form:

$$ED_t = \beta_0 + \beta_1 GDP_t + \beta_2 (GDP)_t^2 + \beta_3 X_t + \beta_4 \Omega_t + \mu_t \dots (1)$$

Where:

ED = environmental degradation captured by CO₂ emissions (GDP) = real GDP

X_t = democracy- a control variable of interest that may often affect environmental quality

Ω_t = channel transmissions variables which allowing democratic institutions to affect indirectly environment quality (CO₂).

μ = Error term

t = the deterministic time trend, used as a crude proxy for technological progress.

The a priori expectations for the coefficients are as follows:

$$\beta_0 > 0; \beta_1 > 0; \beta_2 < 0; \beta_3 > 0 \beta_4 < 0$$

Whenever the coefficient of GDP_t is positive and that of log GDP_t² is negative; it indicates the existence of the EKC hypothesis. All the variables are transferred to log form.

B. Types and Sources of the Data

The empirical analysis considers time series data for the following variables over the period of 1980 to 2018. The choice of the period is based on availability of data.

The variables are GDP per capita (current LCU) which represent early stage of economic growth, GDP per capita (current LCU) squares represent later stage of economic growth, CO₂ emissions per capita is measured in metric tons per capita and is a proxy for environmental degradation and democracy (proxy by civil liberty index) was considered as control variable. The channel transmissions variables allowing democratic institutions to affect indirectly environment quality (CO₂) are income inequality (proxy by Gini coefficient) and investments (proxy by gross investment (current LCU) or Gross capital formation). The variables were sourced from World Bank Group, Knoema, Index Mundi data portal and relevant literatures.

C. Estimation Procedure

The empirical procedure follows three steps. In first step, we estimate our environmental variables carbon dioxide per capita emissions on economic growth and with the control variables and channel transmissions. In a second step, democracy is included in the equation. Lastly, the channel transmissions variables which allow democracy to affect indirectly environment quality (CO₂) is included.

D. Estimation Technique

The estimation of the model specified may yield spurious regression if the variables are not stationary. The group unit root test was employed in order to check this problem. Engle-

Granger co-integration test was also carried out on the group of variables so as to confirm if the series are indeed co-integrated. The co-integrating equation is estimated using recently developed econometric methodology by [27] called Conical Co-integration Regression (CCR). The CCR estimator is based on a transformation of the variables in the co-integrating regression that removes the second-order bias of the OLS estimator in the general case. The long-run covariance matrix can be written as:

$$\Omega = \lim_{n \rightarrow \infty} \frac{1}{n} E(\sum_{t=1}^n u_t) (\sum_{t=1}^n u_t)' = \begin{bmatrix} \Omega_{11} & \Omega_{12} \\ \Omega_{21} & \Omega_{22} \end{bmatrix} \dots\dots\dots (2)$$

The matrix can be represented as the following sum:

$$\Omega = \Sigma + r + r^2 \dots\dots\dots (3)$$

where

$$\Sigma = \lim_{n \rightarrow \infty} \frac{1}{n} \sum_{t=1}^n E(u_t u_t') \dots\dots\dots (4)$$

$$r = \lim_{n \rightarrow \infty} \frac{1}{n} \sum_{t=1}^n E(u_t u_{t-k}') \dots\dots\dots (5)$$

$$\Lambda = \Sigma + r = (\Lambda_1, \Lambda_2) = \begin{bmatrix} \Lambda_{11} & \Lambda_{12} \\ \Lambda_{21} & \Lambda_{22} \end{bmatrix} \dots\dots\dots (6)$$

The transformed series is obtained as:

$$y_{1t}^* = y_{1t} - (\Sigma^{-1} \Lambda_2 \beta + (0, \Omega_{12} \Omega_{22}^{-1})')' u_t \dots\dots\dots (7)$$

$$y_{2t}^* = y_{2t} - (\Sigma^{-1} \Lambda_2 \beta + (0, \Omega_{12} \Omega_{22}^{-1})')' u_t \dots\dots\dots (8)$$

The canonical co-integration regression takes the following form:

$$y_{1t}^* = \beta' y_{2t}^* + u_{1t}^* \dots\dots\dots (9)$$

where

$$u_{1t}^* = u_{1t} - \Omega_{12} \Omega_{22}^{-1} u_{2t} \dots\dots\dots (10)$$

Therefore, in this context the OLS estimator of (9) is asymptotically equivalent to the ML estimator. The reason is that the transformation of the variables eliminates asymptotically the endogeneity caused by the long-run correlation of y_{1t} and y_{2t} . In addition (10) shows how the transformation of the variables eradicates the asymptotic bias due to the possible cross correlation between u_{1t} and u_{2t} .

IV. ANALYSIS OF RESULT

A. Test for Unit Root

A group unit root test was conducted for the series (variables). Eviews default Summary setting was used to compute a full suite of unit root tests (with individual intercept) on the levels of the series as well as first differencing of the series. All of the results from the automatic selection methods indicate the presence of a unit root as such only the result of the first differencing is presented in Table 1.

The results as presented below indicates that the series requires first differencing to achieve stationarity and are co-integrated of the same order. All of the results did not indicate the presence of a unit root, as the LLC, IPS, and both Fisher tests did not fail to reject the null of a unit root. In other words, both the indicators of individual unit root and common unit root tests indicate that the p values (0.0000) are less than 5%, which means rejecting null and accept alternative that there is no unit root at first difference.

To determine the lag length to be used in the test the co-integration test, the Bayesian VAR estimation was employed and the result revealed in Table 2 shows that the optimal lag length, based on the SC and criteria is 1 lag while LR, FPE, AIC and HQ is 3 lags. 1 lag length was eventually chosen.

Table 1: Group Unit Root Test

Method	Statistic	Prob.**	Cross-	
			sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.46367	0.0000	6	219
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-8.46153	0.0000	6	219
ADF - Fisher Chi-square	89.9172	0.0000	6	219
PP - Fisher Chi-square	118.278	0.0000	6	222

Source: Author's computation using Eviews 9 software
 ** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Table 2: Bayesian VAR Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	146.7530	NA	1.62e-11	-7.819611	-7.555691	-7.727496

1	314.0673	269.5619	1.13e-14	-15.11485	13.26741*	-14.47005
2	359.4793	58.02643	7.99e-15	-15.63774	-12.20678	-14.44024
3	415.5516	52.95721*	4.35e-15*	16.75287*	-11.73839	15.00268*

Source: Author’s computation using Eviews 9 software

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Table 3 shows the result of Engle-Granger co-integration test that was performed with a constant. The probability values of the test are derived from the MacKinnon response surface simulation results. The Engle-Granger tau-statistic (t-statistic) does not reject the null hypothesis while the normalized autocorrelation coefficient (which is termed the z-statistic) rejects the null hypothesis of no co-integration (unit root in the residuals) at the 10% level significance. The result shows a divide concerning the co-integration of the variables.

Table 3: Engle-Granger Co-integration Test

	Value	Prob.*
Engle-Granger tau-statistic	-4.024321	0.3059
Engle-Granger z-statistic	-30.26350	0.0630

*MacKinnon (1996) p-values.

Source: Author’s computation using Eviews 9 software

Table 4: Result of Conical Co-integration Regression (CCR)

	Column1	Column 2	Column 3	Column 4
Intercept	0.508491** * (3.612225)	0.530566* * (2.328984)	-1.888683** * (-2.726023)	0.979707 (0.849498)
Economic variable				
LOGGDP	-22.82890 (-0.957711)	-20.62721 (-0.851565)	-8.383284 (-0.455045)	-14.42338 (-0.951665)
LOGGDP ²	11.36794 (0.953988)	10.26611 (0.847790)	4.136087 (0.449065)	7.225319 (0.953111)
Control Variable				
LOGDEMO		-0.002105 (-0.014782)	-0.147702 (-1.305335)	-0.169325* (-1.793863)

Transmission channel variable				
LOGGINI			0.738945** * (3.634420)	0.453000** (2.451288)
LOGGRIV				- 0.118265** * (-2.742095)

*Significant at 10%; **significant at 5%; ***significant at 1%. T-statistics in bracket.

Source: Author’s computation using Eviews 9 software

Table 4 presents the outcomes of the Conical Co-integration Regression (CCR) regression analyses. In column 1, the existence of environmental Kuznets Curve was questioned. The estimates show that at the early stage, economic growth contributed to reducing environmental degradation. Later on further economic growth starts to increase environmental degradation with increasing economic growth as indicated with positive sign on the coefficient of LOGGDP² in the same model. That shows a U shaped relationship between environmental degradation and economic growth. However, this finding indicates no existence of EKC hypothesis in Nigeria because of statistical insignificance of the coefficients at any conventional level of 1%, 5%, or 10%. The inexistence of EKC hypothesis was also confirmed in columns 2, 3, and 4. However, in columns 2 and 3, the control variable (democracy) showed statistical insignificance but was significant when the transmission variables were introduced in column 4.

Indeed, the final regression in column 4 indicates the effect of economic growth, democracy as a control variable and its transmission channels such as gross domestic investment and income inequality on environmental degradation (carbon dioxide emissions per capita). Column (4) of Table 4 shows that an improvement of democracy contributes to a reduction of carbon dioxide emissions per capita (environmental degradation). The effect is -0.169325 and significant at 10% level. One plausible reason for this result is that since return to democracy, Nigeria’s environmental regulations are gradually becoming firmer, with institutions being put in place for environmental management and monitoring. This result confirms [28] who concluded that democracy (democratic institutions) improves environment quality.

Still, in column (4) of Table 4, gross domestic investment (LOGGRIV) was introduced in the regression. It was discovered that gross domestic investment has a negative and significant effect on carbon dioxide emissions per capita (environmental degradation). Actually, an increase in investments of 1% contributes to reduction of carbon dioxide emissions per capita by 0.12%. Overtime, the Nigerian nation has experienced a enormous expansion in her revenue profile via oil exports. She has also relished cycles of an oil boom with consecutive governments making use of the resources of

the nation to execute its budget. Astonishing, there has been also a growth in her expenditure pattern overtime. This result shows that the increase in capital expenditures has translated into the increased capital formation and accordingly reduction of carbon dioxide emissions per capita in Nigeria.

A closer look at column (3) of table (4) when income inequality was introduced in the regression reveals that environmental degradation (carbon dioxide per capita) increased. This aligns with [29]. Invariably, income inequality worsens environmental degradation in Nigeria. This result was confirmed in column 4 as well. Income Inequality is very pronounced in most part of economically developing nations like Nigeria where earnings and assets are largely unevenly distributed. There are very rich people with a high standard of living who has adequate means to essentials of life such as balanced three square meals, comfortable housing with basic infrastructure etc. as well as some other very poor people with a low standard of living, who daily struggle for survival.

As such, the poor needs to interact with the environment in many ways to meet some basic human needs. These interactions however bring many associated problems like pollution, land degradation, deforestation, bush burning, wood-fuel demand (charcoal), etc. Invariably, the price of income inequality in Nigeria is environmental degradation and it is poverty- driven. In spite of the numerous government poverty alleviation programs initiated since 1980 till date, the scale of economic inequality has reached an extreme level. It should be noted that the inclusion of gross domestic investment and income inequality in the regression (column (4) of table 4) improved the magnitude and the significance of the coefficients of democracy variable on environment quality.

V. SUMMARY, CONCLUSION AND RECOMMENDATION

The association between environmental quality and democracy is a hotly debated issue in the scholarly literature. Literature tends to assume a positive relationship between democracy and environmental quality. This paper seeks to contribute to existing debates by using the Environmental Kuznets Curve analysis approach to investigate the case of Nigeria. The econometric tests resorted to was group unit root tests and Engle-Granger co-integration test. The Conical Co-integration Regression technique was used to estimate the co-integration equation for time span of 1980 to 2018. The main findings of this analysis are as follows: regarding the validity of EKC, the result indicates that economic growth contributed to reducing environmental degradation at initial stage of development. Thereafter, further economic growth starts to increase environmental degradation with increasing economic growth as indicated with positive sign on the coefficient of LOGGDP2. However, because of statistical insignificance of

the coefficients at any conventional level of 1%, 5%, or 10% , this indicates no existence of EKC hypothesis in Nigeria. On the other hand, improvement of democracy and gross domestic investment showed significant contribution to reduction of carbon dioxide emissions per capita (environmental degradation). Actually, an increase in investments of 1% contributes to reduction of carbon dioxide emissions per capita by 0.12%. Similarly, improvement of democracy had a significantly negative effect of 0.17% on carbon dioxide emissions per capita. On the contrary, income inequality was shown to worsen environmental degradation in Nigeria by 0.45%.

A limitation for the study is that certain variables such as population, education, urbanization, research and development, energy consumption and foreign direct investment net inflows which could have been used as control variables were not introduced. However, this does not affect the results in this case, since the tests carried out revealed that the variables and robust technique used in the study are appropriate. Nonetheless, there is still room for improvement. Additional empirical investigation can done by expanding the size of the data, applying different estimation techniques and by making decomposed analysis for some of the suggested control variables. This can further be extended by making a comparison of different regions of the world.

In conclusion, environmental quality is definitely consumption public good. Thus the costs of degradation are borne by society rather than just the polluter. Hence, in order to maintain and improve the existing level of environmental quality in Nigeria, roadblocks to a strong democracy in Nigeria at all levels of government should be removed. Likewise, environmental laws and policies targeted at ameliorating environmental degradation situation in Nigeria should be effectively enforced. Hence, the major environmental law enforcement agency in Nigeria should be given more authority on all environmental law enforcement efforts including the environmental permitting and monitoring of all new and existing projects including the approval of strategic environmental impact assessment

The government should construct an inclusive society, where everyone has equal access to social and economic amenities; political structures, and administrations in a bid to reduce inequality. As such, the social inclusion should be in terms of attitudinal, environmental and institutional inclusion.

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