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Feasible Environmental Kuznets and Institutional Quality in North and Southern African Sub-regions

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ABSTRACT

One of the goals of Africa as a developing continent is to grow and also reduce environmental pollution. Most studies investigate the presence of inverted U-shaped environmental Kuznets curve (EKC) using pollutants such as carbon dioxide (CO_2), the use of point pollutants such as suspended particulate matter (SPM) is not so popular in literature. Similarly, most studies that assess the role of institutions in the income-pollution nexus do not investigate their capability in achieving feasible turning on the EKC. Focusing on three pollutants, namely: CO_2, nitrogen oxide (N_2O) and SPM, this study employs system generalised method of moments to assess the role of institutions in two sub-regions (North and Southern Africa) in attaining EKC turning points. Results, among others, indicate that the both sub-regions did not attain a level of average income capable of turning EKC round for CO_2 and N_2O but do for SPM. It is also revealed that Southern Africa attained EKC faster than North Africa. It is therefore recommended that for the purpose of achieving the goal of green growth, the institutional quality should be strengthened in the two Africa sub-regions, particularly in Southern Africa.

Keywords: Economic Growth, Environmental Kuznets Curve, Environmental Pollution, Institutional Quality, Land Degradation, North Africa, Southern Africa.

JEL Classifications: O13, O44, Q56

1. INTRODUCTION

The continent of Africa is one of the most vulnerable to environmental pollution effect in the world (Environmental Resources Management, 2009). Environmental pollution is being caused by anthropogenic effects on the continent's natural environment and this has major impacts on human and nearly all forms of endemic life. Factors contributing to environmental pollution include; deforestation, desertification, population explosion, crude agricultural practices, mining activities, and consumption of fossil fuel (Akinyemi et al., 2017a). These factors are responsible for a large volume of pollutants in Most Africa countries particularly in the rural areas of Madagascar, Cameroon, Liberia, Democratic Republic of Congo, Ethiopia, Kenya, South Africa, Egypt, Nigeria, among others (ERM, 2009). The aforementioned had resulted in decreased in food production, damaging ecological effects and general decrease in quality of living in the continent. World Health Organisation-WHO, 2013 report indicates that great emission of Carbon dioxide, other green house gases (GHGs) and suspended particulate matters (SPMs) impact negatively on human health in Africa.

The indices of environment pollution in Africa and their control factors vary across the sub-regions. Statistics from the World Development Indicators (WDI) (World Bank, 2016a) show that between 2005 and 2015 population density per square kilometre of land increased at an average rate of 1.7% in Central Africa 2.7% in Sub-Sahara Africa and 1.8% in North Africa. Within the same period carbon-dioxide emission declined by an average rate of 1.4% and 0.23% in Central Africa and Southern Africa, respectively but increased by 2.1 percent North Africa. Similarly trend was revealed between growth rate of agriculture value added per worker and emissions. Sub-regions with a high growth rate of agriculture value added per worker recorded high average growth rate of emissions. It is also observed that sub-regions with a higher Foreign Direct Investment (FDI) witnessed a higher growth rate of emission.

Furthermore, it is noted that factors that curtail environmental pollution in Africa had been fluctuating in the past two decades. The WDI of the World Bank (2016) show that within the 2005–2015 gross Official Development Aid for general environment protection on the average declined in the Central Africa but significantly increased in Sub-Sahara Africa and North Africa. In the same vein institutional quality as reported by the World Government Indicators (WGI) (World Bank, 2016b) show that regulatory quality and control of corruption witnessed a moderate improvement in North Africa but declined in North Central and Sub-Sahara Africa. Generally, within the period 1995–2015, it can be said that while the factors that contribute to environmental pollution were on the increase in Africa those factors that aid improvement in environmental quality were declining.

To achieve sustainable growth target as desired by Africa economy, economy will has to grow with a minimal or environmental pollution. The extent to which this is achieved depends largely on the growth rate of the economy *vis-à-vis* the environmental pollution. If the growth rate of environmental pollution will be effectively checked as economic continue to grow; the interaction between environmental pollution and economic growth cannot be left to the whims and caprices of market forces. Institutions, as regulatory forces must play a significant role. First, a complex relationship exists between the variable of environmental pollution and economic growth as well as among the variables of environmental pollution Akinyemi et al. (2017). Second, environmental quality is a luxury public good which the poor who bear the brunt of environmental pollution can hardly afford (Ananthan, 1996; Asthana and Asthana, 2006).

Also environmental pollution places stress on natural resources and social infrastructure which may eventually result into conflict, arm struggle, immigration and other social vices in detriment to the desired economic growth (United Nations Research Institute for Social Development [UNRISD], 1994). UNRISD (1994) noted that internalising the externalities of environmental pollution raises much complex issues that cannot be adequately solved by market forces; and as such, the role of regulatory authority has been advocated by different researchers like Powell (2003), Kshetri (2012), Alege and Ogundipe (2013), Osabuohien et al. (2013; 2014), Aliyu et al. (2015), Akinyemi et al. (2016; 2017b), among others, Africa continent had been experiencing low institutional quality measure in the past two decades. Statistics from Economic Freedom of the World (2012) shows that economic freedom measure on the scale of 0 – 10 units decreased steadily from the 1980 to 2010. Similarly political right ratings from the quality of government institute (2014) revealed the same trend. Again, data from WGI (2014) reported a low growth rate for the continent in the area of control of corruption, rule of law, effectiveness of government among others.

An attempt to examine the pollution-income relationship has witnessed vast attention in literature, with several researchers employing various datasets and methods in the study of this relationship in Africa. Empirical literature show that many researchers employed Carbon dioxide emission as the endogenous variable in their models to investigate the existence of the popular environmental Kuznets curve (EKC). One major reason popularly offered by these authors for the use of carbon dioxide to proxy environmental pollution is that it constitutes the bulk of the GHGs that determine atmospheric quality. Good as this may sound, it must be noted that Carbon dioxide emission or any other gaseous emission is not the only determinant of the level of environmental pollution particularly in developing countries of Africa. There are several other point pollutants with more devastating impact on environment and livelihood in the short-run than the global emissions.

While few studies evaluated the impact some point of these pollutants, the income threshold needed to avert the surging effect of the pollutants is yet to be ascertained for the African economies. Therefore, in an attempt to expand and widen the scope of study in the field of environmental pollution and economic growth in Africa, this study tests the presence of EKC in two Africa's sub-regions (North and Southern Africa) using carbon emissions, Nitrous oxides and SPMs as indicators for environmental pollution. The study compares the strength of institutions in attaining EKC in the two sub-regions using both global and point pollutants. The two sub-regions are more industrialised than other sub-regions in Africa they have moderately high population and well advanced in agriculture. In the recent years, both sub-regions received higher environmental aid than other sub-regions. They have different cultural background and climatic differences. These factors have influence on the role of institutions in curtailing environmental pollution and the pattern of EKC in the two sub-regions.

2. BRIEF LITERATURE REVIEW

The role of institutions in the economic growth of a nation cannot be overemphasised. North (1994), Williamson (1998), Aron (2000), Chu (2003), Kugbee and Insa (2015) and Victor (2017) and others unanimously agree that institutions matter in economic growth. Williamson (1998), specifically stated that the neoclassical economic theorists should consider North (1994) theory of institution and incorporate in future studies on economic growth. However, Melanie (2007) and Nondo et al. (2016) posits that only efficient institutions are growth promoting as such institutions encourage individuals to engage in productive activities by providing appropriate incentives and establishing a stable structure of human interactions that reduce uncertainty. This is in tandem with the argument by Akinyem et al. (2017) who opined that the key role of the environmental institution is to provide incentives for economic growth rather than direct regulations to protect the environment.

Hence, since sustainable economic growth is the goal, environmental policy that strictly regulate the environment without paving the way for economic growth is inefficient. Postner and Sunstelin (2007) defines two types of efficiency: A rule promoting efficiency, termed substantive efficiency and a rule designed to redeemed cost or increase the accuracy of using the systems of rules termed procedural efficiency. Cole (2003) argues that affluence in developed countries is as a result of cumulative result of efficient institutions over time while poverty in poor countries is traceable to inefficient institutions. In other words, strong institutions favour high economic growth and development while weak institutions tend to slow down the process of economic growth and economic development.

The new institution economics (NIE) propagated by Coarse (1937), North (1994), Oliver (1992), Rauscher (2005), Khadarro and Sultan (2013) among others, maintains that institutions matter and the determinants of institutions can be analysed with the aid of economic theory. From the submission of Oliver (1992), Acemoglu and Simon (2005), Chang (2005), Davis (2010), Alam et al. (2017) and host of others, it becomes apparent the evidence of reverse causation between institution and growth effect. This suggests that Institutions influence economic growth and growth can also influence institutions. Strong institutional arrangement can lead to a higher economic growth and vice versa. However, according to the proponents of NIE, the converse is not true, weak institutions cannot bring about increased growth but increased rate of growth may result into weak institutions.

The inverted U-shape of EKC explains that pollution emission from economic activities initially increases, reaches a maximum and then begins to fall as the economy continues to grow. Although more outputs imply more pollution emission; pollution intensity of production varies across countries and economic sectors and as well depends on the goods, production technique, level of development of the economy among others. Institution plays a dominant role in the choice of type of goods to produce, scale of production, technique of production, method of distribution, as well as control of pollution resulting from production and consumption processes. Consequently, the length and the width of the U-Shape of EKC depends, among others on the quality of economic, political, legal, market, financial and environmental institutions. In recent study by Al-Ayouty et al. (2017), it was found that the activities of the manufacturing sector influences environmental quality through channels like CO_2 emissions and changes in forest area.

Panayotou (1997) studied the EKC relationship for sulphur dioxide for the purpose of gaining a better understanding of the income-environment relationship and as a basis for conscious policy intervention. The author used sample of 30 developed and developing countries for the period 1982–1994 and employed a set of five quality of institution indicators obtained from Knack and Keefer (1995). This quality of institutional indicators include; respect for and enforcement of contracts, efficiency of the bureaucracy, the rule of law, the extent of government corruption and the risk of appropriation. Since all these variables are highly correlated, the author chose to use an index for respect/enforcement of contracts. He found that improvements in the quality of institutions by 10 percent resulted in a reduction of sulphur dioxide emission by 15% and therefore concluded that quality of policies and institutions in a country can significantly reduce environmental pollution at low-income levels and speed up improvements of higher income levels. Based on his finding, Panayotou (1997) asserted that policies such as more property rights under the rule of law, better enforcement of contracts and effective environmental regulations can help flatten the EKC and reduce the environmental price of higher economic growth. Furthermore, Panayotou (1997) results show a strong correlation between property rights enforcement and environmental quality and this is consistent with findings of Norton (2002) that documents a related linkage between property rights and income.

Using panel data for 74 developing countries and 47 developed countries within the period between 2005 and 2011, Olusola, (2016), results result shows that human capital contribute to gross domestic product (GDP) in developed region through investment flow in primary and tertiary education. This is contrary to the case in developing region. Olusola (2016) also found that domestic investment is not positively and significantly contribute to the economic growth in developing region until other investment such as FDI are taking into consideration. Using the annual percentage change in forest area between the years 1972–1991 as an indicator of environmental quality, Bhattara and Hamming (2001) analysed the EKC relationship for tropical deforestation and income controlling for political and governing institutions, macro-economic policy and demographic factors. His results shows that the variables of institutional quality, the rule of law, quality of bureaucracy, level of corruption in government and enforcement of property rights are relatively more important in explaining the process of tropical deforestation than other frequently used factors such as population growth and shifting cultivation.

The studies of Quin (1998), Goklany (1999), Deacon (1999), Bhattarai and Hanming (2001). Pao and Tsai (2011), Hassaballa (2013) and host of others control for institutions and validated the existence of inverted U-Shaped EKC. Alege and Ogundipe (2013) include control of corruption in their model for the purpose of measuring the government efficiency in adopting cleaner technologies and relevant abatement measures with rising income. They obtain data from the World Governance Indicators (2012) of the World Bank. Their results of analysis show that the mean of control of corruption is negative at −1.112 which is not unconnected with the prevalence of corrupt practices in Nigeria. In addition, the value of differencing parameter for control of corruption exhibits a long lived shock deviation (i.e. it takes a long time for its mean to revert) and non-stationary. The study concluded that improvements of institutional quality, particularly the control of corruption will reduce the level of carbon emissions in Nigeria. The study of Alege and Ogundipe (2013) like many others on Africa limit variables of institutional quality one or two in the model hence an empirical study that particularly captures governance effectiveness, rule of law, control of corruption and regulatory quality in the EKC model is needed. Furthermore, it is noticed that studies on Africa have not really focused on the determination of the turning on the EKC. This is very important for the purpose of knowing the income threshold by which the African countries will start growing green.

Sileem (2015), examined the existence of a Modified Environmental Kuznets Curve (MEKC) for the Middle East and North Africa. With the use of panel data with fixed effect specification for the period between 2004 and 2013 the existence of MEKC was found for MENA Countries Sileem (2015) results also showed that a significant control of corruption decreased CO_2 emission. The Granger causality test confirmed the presence of a uni-directional relationship between CO_2 per capital and corruption. Other methods of analysis employed in most non-African studies include ordinary least squares (OLS), generalised least squares, Dynamic OLS, two stage least squares (2SLS), and autoregressive distributive lag (ARDL). Also, De Bruyn Van Den and Opschoor (1998) employed OLS method to estimate EKC separately for Netherlands, UK, USA and West Germany between 1960 and 1993. It was found that EKC did not generally fit for all the countries as each country has its own technological, structural, energy price and economic growth path which result in specific emission situation. The theoretical inverted U-shape EKC does not hold in the long run but rather an N-shape EKC.

Ming-Feng and Daigee (2006) used panel data on Taiwan to examine the EKC relationship per capita income and air pollution in Thailand using a system of equations. The Simultaneous model was estimated using the 2SLS method. The inverted U-Shaped relationship was found between Nitrogen dioxide, Carbon dioxide and per capita income in Taiwan. Haliman et al. (2013) formulated a three equations simultaneous model and used 2SLS method to analyse the relationship among CO_2 emission, quality of life and economic growth in Asian 8 between 1965 and 2010. They found the existence of traditional inverted U – Shape EKC for Asian 8. Agarwal (2012) investigated the nexus among carbon-dioxide emission, trade intensity, FDI and economic growth for Malaysia between 1980 and 2008 using ARDL Co-integration and VAR. His result of analysis provided support for EKC but not PHH. Shahbaz (2012) used ARDL, co-integration, VECM and Causality test in the model developed for Portugal between 1971 and 2009. Variables included were GDP, energy intensity, financial development and carbon-dioxide emission. His finding validates the inverted EKC.

Alam et al. (2017) using a system of GMM to analyse the nexus between institution and economic growth for a panel of 81 countries found that there is significant effect of government effectiveness on economic growth. Itochoko and Pierre (2017) with a sample of 18 countries and between 1985 and 2013 used GMM method estimation and found that the nexus of natural resources and economic growth in Sub-Sahara Africa depends largely on the institutions. Ogundipe et al. (2015) analysed their model of environmental quality- Economic growth that included SPM and CO_2 endogenous variable and environmental quality among others as exogenous variable and found the existence of EKC for some populations but not for others in West Africa.

From the review of literature it is noticed that result of analysis are mixed when institution is controlled for in the pollution – income nexus. Results depend largely on the type of environmental pollution and institutions employed. Most studies proxy environmental pollution with global emission such as carbon-dioxide. For such emission, it may be difficult attain EKC faster with local or regional institutional quality. With the use of point pollutants or local pollutants the assessment of national or regional institutional quality in attaining inverted U-Shaped EKC will be more realistic. Furthermore, most studies do not determine the turning points on the EKC for the pollutants employed. This is important as it reveal the income level whereby a country or region will start growing green. Finally, a comparative analysis of two sub-regions in Africa with regards to EKC has not received much attention in the literature. Thus, this study fills the aforementioned gap.

3. TRENDS IN POLLUTION IN NORTH AND SOUTHERN AFRICA

3.1. Pollution Growth Trend in North Africa

Figure 1 shows the graph of the growth trends in percentage rates of CO_2, N_2O and PM 2.5 in North Africa. From Figure 1, CO_2 emission rose sharply between 1998–2000, 2002–2005, 2007–2009 and 2011–2012 reaching the peaks in 1998, 2003, 2008 and 2012.The decline in carbon dioxide emission is observed between 2001 and 2002, 2007, 2009 and 2011. Lowest growth rate of CO_2 emission is observed in 2002, 2007 and 2011. The emission of N_2O rose between 1996 and 1998, declined between 1998 and 2001 and witnessed a rise between 2002 and 2008, and 2010. N_2O growth reached the peaks in 2002, 2004 and 2010 and the declined between 1999 and 2002 and 2007 and 2010. The growth of PM 2.5 appears constant within the period of 1999–2004, but rose sharply thereafter and remains approximately constant between 2005 and 2010. It is observed for some period high growth rates of the emission and PM 2.5 follow the same pattern while for others this is not the case. The general implication of this is that CO_2, N_2O and PM 2.5 in this Africa region influence one another. This could be as a result of the fact that they emanate from difference sources.

3.2. Southern Africa

Figure 2 is the graphical illustration of the growth trends of CO_2, N_2O and PM 2.5 in Southern Africa sub-region.

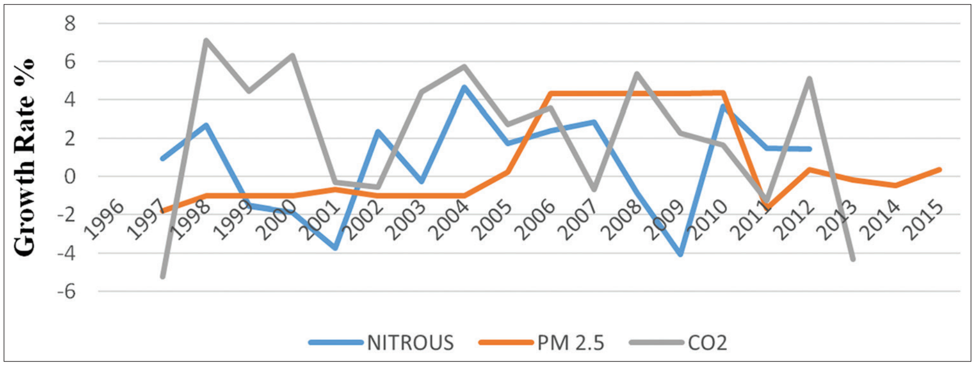
From Figure 2 both CO_2 and N_2O followed nearly the same pattern of growth between 1997 and 2004. However, while N_2O grew above CO_2 between 2000 and 2002, 2005 and 2007, CO_2 growth rates were higher than that of N_2O in 2002–2004 and 2008–2009. It is noted also that N_2O rose sharply between 2005 and 2007 and declined sharply between 2008 and 2009. This might not be unconnected with the fluctuations in economic activities and other environmental issues during the period. In general the increased growth rates of CO_2 and N_2O emissions within the period in this region are more than the period of decline. PM 2.5 growth in Sub-Sahara Africa appear nearly constant between 1996 and 2010. It reached the peak in 2011 and declined between 2011 and 2015. The reason for this pattern of growth in PM 2.5 in Sub-Sahara Africa Countries can be attributed to effective checks and policies directed towards copy excessive burning and consumption of fossil fuels during the period.

4. METHOD OF ANALYSIS AND DATA

4.1. Model Specification

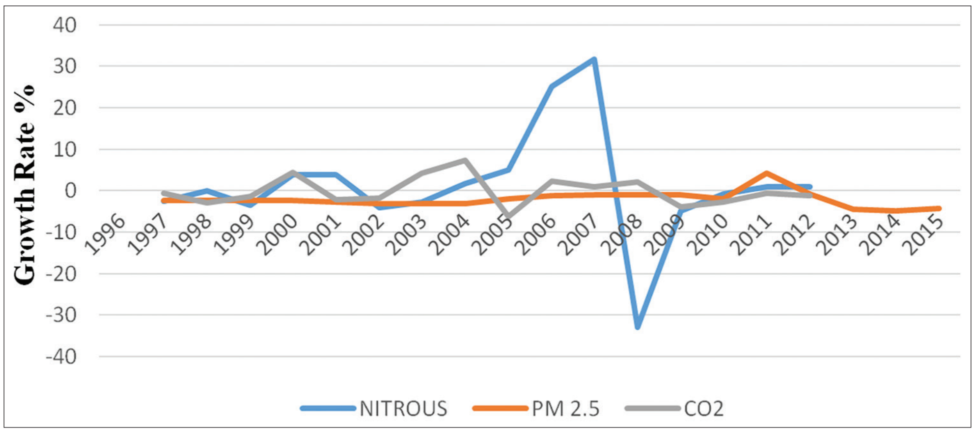
This study adopts the standard EKC model following the pioneer studies of Grossman and Krueger (1991) and subsequently adopted by Alege and Ogundipe (2013), Jing (2008) and Osabuohien et al. (2013). The EKC model captures the Environmental Kuznets

Figure 1: Trend of CO_2, N_2O and PM 2.5 in North Africa



Source: Authors' computation

Figure 2: Trends of CO_2, N_2O and CO_2 emission in Southern Africa



Source: Authors' computation

Effect using three environmental variables (per capita carbon emissions, nitrous oxide emission per capita, mean annual surface temperature and mean annual rainfall). The specification assumes environmental pollution as a function of income level and the squared of income level. The inclusion of income at levels and the squared of income is important to the EKC specification; while the former is used to capture the nature of pollution-income relationship at the initial stage of development, the latter tests for the validity of EKC by illustrating whether a turning point had occurred or not. The specification of the basic EKC model is expressed thus:

$$\ln(ENV)_t = \beta_0 + \beta_1 \ln\left(\frac{GDP}{P}\right)_t + \beta_2\left(\ln\left(\frac{GDP}{P}\right)\right)_t^2 + \varepsilon_t \quad (1)$$

Where ENV_t is environmental pollution and is a column vector of three variables, such that $ENV_t = \begin{Bmatrix} CO_{2_t} \\ NO_{2_t} \\ SPM \end{Bmatrix}$, $\frac{GDP}{P}$ is real GDP per capita income, ε_t is the disturbance stochastic term, β_0, β_1 and β_2 are elasticity coefficients.

Following Akpan and Chuku (2011) and Ogundipe et al. (2014), the theoretical interpretation of the sign and relationship of the parameters are shown as follow:

1. $\beta_0>0$, $\beta_2=0$, it indicates linear shape and monotonically increasing function. As income rises, environmental pressure is increasing.
2. $\beta_1<0$, $\beta_2=0$, it indicates linear shape and monotonically decreasing function. As income rises, environmental pressure is decreasing.
3. $\beta_1>0$, $\beta_2<0$, it indicates inverted U-shape. As income reaches a threshold, environmental pressure decreases as income rises
4. $\beta_1<0$, $\beta_2>0$, it indicates U-shape. Environmental pressure falls with falling income and increasing when income is rising
5. $\beta_1<0$, $\beta_2<0$, it indicates reversed N-shape, environmental pressure decreases first, then increases and later decreases
6. $\beta_1=\beta_2=0$, it indicates horizontal line. Income does not affect environmental pressure.

In an attempt to assess the stability of the EKC model for the North and Southern Africa economies, other important macroeconomic variables pertinent in explaining the extent of environmental pollution are included. The basic EKC model in equation 4.10 is augmented in order to address the objectives one and two earlier specified in the study.

$$\ln(ENV)_t = \beta_0 + \beta_1 \ln\left(\frac{GDP}{P}\right)_t + \beta_2\left(\ln\left(\frac{GDP}{P}\right)\right)_t^2 + \beta_i \sum_{i=3}^{8} \ln(X)_t + \varepsilon_t \quad (2)$$

$$\ln(SPM)_t = \alpha_0 + \alpha_1 \ln\left(\frac{GDP}{P}\right)_t + \alpha_2 \left(\ln\left(\frac{GDP}{P}\right)\right)_t^2 + \alpha_i \sum_{i=3}^{8} \ln(X)_t + u_t \quad (3)$$

Where X_t is a vector of explanatory variables added to the basic EKC model such that:

X_t={$Pden_t$, Fdi, Edu, $Enginvt_t$, Invt, Agricpdty, $Eaid_t$, $Inst_t$}.

Agricpdty is agricultural productivity, $Pden_t$ is population density, $Enginvt_t$ is investment in energy sector, $Invt_t$ is national investment, and Ins_t captures the quality of institutions. ENV is a vector of environmental pollution variables that is: Carbon-dioxide emission (CO_2), nitrous oxide (N_2O), and suspended particularly matter (SPM).

i. Population density (Pden): This is captured using the number of persons per square kilometre. The higher the population density, the greater will be the intensity of pollution and pressure on environmental services and resources. It is expected that a densely populated community experiences a faster degrading environment than the sparsely populated ones. The inclusion of the variable becomes pertinent as most cities are not only populated but exerts heavy pressure physical and natural resources. Intense and rapid human concentration tends to threaten the environment through expansion and intensification of agriculture, uncontrolled growth of urbanization and industrialisation, and destruction of natural habitats.
ii. Foreign direct investment (FDI): The past decade has also seen all trends of environmental pollution accelerate – for example, greenhouse gas emissions, deforestation, loss of biodiversity. Such patterns of environmental destruction have been driven by increased economic activity, of which FDI has become an increasingly significant contributor. Currently, much of the debate on FDI and the environment centres on the "Pollution Havens" hypothesis. This basically states that companies will move their operations to less developed countries in order to take advantage of less stringent environmental regulations. In addition, all countries may purposely undervalue their environment in order to attract new investment. Either way this is likely to result in excessive (non-optimal) levels of pollution and environmental pollution.
iii. Education (Edu): Education constitutes the effectiveness of human capital development in bringing about reduction in environmental pollution thereby increasing environmental quality.
iv. Investment in energy (Enginvt) is a measure of expenditure in energy investment. Africa generally has low investment in energy sector and this contribute to large volume of consumption of dirty energy.
v. National investment (Invt) is the local investment and has the effect of increasing or decreasing the rate of environmental pollution.
vi. Agricultural productivity (Agricpdty,) is a measure of agricultural output value added. Agriculture in Africa is largely being practiced by crude technology that generates a lot of emission which in turn decreased the environmental quality.
vii. Environmental aid (Eaid): studies have argued that aid has an essential role to play in the promotion of economic development, and can be helpful in promoting principles of sustainability. On the other hand, not only have many critics doubted the efficacy of aid but many have detailed the environmentally damaging consequences of aid projects. But it is generally believed aid targeted at environmental protection (in terms of funds or technical assistance) can ameliorate the extent of environmental pollution.
viii. Institutional quality (Inst), is the measure of the capability of the institutions to regulate environmental quality. Institutional quality scores in the area of regulatory quality, control of corruption, rule of law, independence of judiciary etc. are generally low in Africa and this suggest that institution may not have significant effect in controlling environmental pollution in the light of economic growth.

To ascertain the level of income that fulfils the threshold where polluting begins to dwindle with rising income, it is necessary to estimate the turning point. The equation of the turning point is given as:

$$\frac{GDP}{P}(TP) = e - (\beta_2 / 2\beta_1) \quad (4)$$

4.2. Technique of Estimation

In an attempt to provide empirical testing of EKC in North and Southern Africa sub-regions, this study adopted the System Generalised method of Moments technique of estimation[1]. This is in order to overcome the problem of endogeneity that is associated with long run growth determinants. According to Arellano and Bond (1991), a commonly employed estimation procedure to estimate the parameters in a dynamic panel data model with unobserved individual specific heterogeneity is to transform the model into first differences. Sequential moment conditions are then used where lagged levels of the variables are instruments for the endogenous differences and the parameters estimated by GMM. Blundell and Bond (1998) documented the fact that the GMM estimator in the first difference (DIFF) model can have very poor finite sample properties in terms of bias and precision when the series are persistent, as the instruments are then weak predictors of the endogenous changes. Blundell and Bond (1998) proposed the use of extra moment conditions that rely on certain stationarity conditions of the initial observation. When these conditions are satisfied, the resulting system (SYS) GMM estimator has been shown in the Monte Carlo studies (Blundell and Bond, 1998; Blundell et al., 2000) to have much better finite sample properties in terms of bias and root mean squared error than that of the DIFF GMM estimator.

1 Given the fact that in our panel data, T>N, we did a robustness check using the pooled mean group (PMG) estimator, which allows for both pooling and averaging of coefficients (the intercepts, short-run coefficients, and error variances) that may be heterogeneous across groups, but constraints the long-run coefficients to be homogeneous across groups (Pesaran et al., 1999). From the PMG results, not reported, we did not observe significant differences with those from SGMM; hence, we focused our analysis on SGMM.

Table 1: Descriptive statistics

Region	Obs	Mean	Std.dev	Min	Max	Variance	Skewness	Kurtosis
North Africa								
CO^2	96	3.0442	2.6749	0.1591	9.0180	7.1548	1.3704	3.6884
gdpk	96	3824.177	2622.58	979.307	11467.6	6877925	1.7875	5.6161
Edu	92	203.0576	51.1253	98.0504	277.2402	2613.799	−0.4732	2.3723
Env-aid	96	1.35e+07	1.80e+07	14472	4.40e+07	3.25e+14	2.3328	10.2076
Pden	96	42.0356	30.9012	3.0333	86.0524	954.8869	0.0229	1.2301
Inv	80	2.74e+10	1.93e+10	6.60e+09	7.40e+10	3.74e+20	1.2143	4.1149
Fdi	96	2.6412	2.0261	−0.3899	7.6457	4.1050	1.3831	5.1088
Agric_pdty	80	3634.63	1050.467	1792.08	5475.86	1103481	0.1324	2.0883
Enginvt	64	4.20e+08	5.31e+08	0	1.80e+09	2.82e+17	2.4039	9.1094
Inst	90	2.7401	0.5170	1.6863	3.4832	0.2673	-0.3693	1.9931
Southern Africa								
CO^2	160	1.6709	2.5619	0.0695	9.6187	6.5635	2.4084	7.3873
gdpk	160	2876.941	2375.309	253.774	7568.45	5642092	0.5691	1.9281
Edu	146	162.2553	32.8628	80.4252	213.195	1079.962	−0.2885	2.4791
Env-aid	159	6675342	7750194	−3000	2.70e+07	6.01e+13	1.3017	3.7964
Pden	160	42.4298	41.6881	2.3053	166.53	1737.899	1.6011	5.1870
Inv	144	1.08e+10	2.10e+10	−6.50e+08	8.20e+10	4.41e+20	2.6338	8.6550
Fdi	160	4.6444	6.5733	−5.9775	27.9026	43.2077	3.1135	15.4098
Agric_pdty	144	1778.615	2177.422	190.151	8297	4741167	1.8198	5.7380
Enginvt	114	4.44e+08	9.48e+08	0	3.10e+09	8.99e+17	3.9199	19.8462
Inst	150	3.1796	0.6296	1.8342	4.2125	0.3964	−0.2340	2.3911

GDP per capita (GDP/P) is simply here denoted as gdpk. Source: Authors' Computation using Stata 13.0. GDP: Gross domestic product

4.3 Data Sources and Measurement

The data used were obtained from; WDI, World Governance Indicators and Iceland Institute Data market. For GDP per capita constant US dollar, Population density in square kilometre landed area, Energy investment in US dollar, Agriculture and National Investment in US dollar data were obtained from WDI 2014, 2015. Also for environmental pollution variables; carbon – dioxide emission in metric tonnes, nitrous oxide emission in metric tonnes carbon-dioxide equivalent, and SPMs data in micro-metres were obtained from WDI 2015. Data on environmental aid were obtained from Iceland institute data market while institutional quality scores; control of corruption, rule of law, regulatory quality and governance efficiency data were obtained from WGI 2016.

5. RESULTS AND DISCUSSION

5.1. Descriptive Analysis

Table 1 illustrates the summary statistics of the variables the two sub-regions- North Africa and Southern Africa[2]. The mean value of CO_2 emissions in North Africa is three metric tons per capita, the maximum is nine metric tons and the minimum is 0.16 metric tons. The gap illustrates a considerable difference in emission among economies in Northern Africa. The average level of pollutant emissions in North Africa tends to be larger than that of Southern Africa, likely because this Northern Africa comprises the largest concentration of oil producing and fast emerging African economies. The higher level of CO_2 emission in North Africa suggests that this region faces a higher environmental pollution challenges than Southern Africa. Also, average per capita income was higher in the North than Southern Africa. The implication of this is that North Africa has a higher income capacity to combat environmental pollution than Southern Africa. However, the values obtained for standard deviation and variance show that income is more evenly distributed in Southern Africa than North Africa suggesting that more people will likely be able to alleviate environmental pollution in the Southern Africa than in the North Africa. In the same manner, population density tends to be relatively lesser and more evenly distributed in the North than South Africa. This paints a picture of lesser environmental challenge in the North compared with the South. The level of education appears higher in the Southern Africa as indicated by values obtained for standard deviation and variance. More people in the Southern Africa are educated compared with the North. The implication of this is that people Southern will likely have a better awareness and knowledge of environmental pollution mitigation and abatement. It also worthy to note that environmental aid tends to be significantly higher in the North with heavy concentration on exporting commodity goods due to the fact that extractive industries are prone to be pollution intensive. On the contrary, Southern Africa has the larger investment in the energy sector while agricultural activities tend to be predominant activities in North.

5.2. Econometric Results

The empirical results obtained from the estimation are reported in Tables 2 and 3, respectively for North Africa and Southern Africa[3]. The estimation was based on the system GMM using the *xtabond2* specification for two-step options. The use of the two-step estimation is premised on its strength in the presence of heteroscedasticity and serial correlation, the two step-step

2 The sampled countries in North Africa include: Algeria, Egypt, Libya, Morocco, North Sudan, and Tunisia; while those in Southern African include: Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa and Swaziland. The information on them was obtained from http://www.eatradehub.org/countries.

3 We started with preliminary analyses such as: correlation test and variance inflation factor; the results (not reported) indicate that there is no issue of collinear relationship among the explanatory variables.

Table 2: EKC turning point in North Africa

Variables	North Africa			Turning points		
	lco2	lno2	lspm	lco2	lno2	lspm
L.lco2	0.704***					
	(0.169)					
Lgdpk	3.425	−13.13***	14.15***			
	(4.009)	(3.358)	(3.912)			
$Lgdpk^2$	−0.218	0.815***	−0.895***	$8541.64	$7982	$628.5
	(0.252)	(0.213)	(0.248)			
Lpden	0.0833**	0.132***	0.114**			
	(0.0403)	(0.0354)	(0.0478)			
Ledu	0.378	−0.0977	−0.202*			
	(0.250)	(0.200)	(0.272)			
Lenginvst	−0.00729	0.00287	0.0272**			
	(0.0125)	(0.0104)	(0.0116)			
Lfdi	0.00512	0.0257**	0.0282**			
	(0.0140)	(0.0116)	(0.0135)			
Linv	−0.0119	0.0462	0.0505			
	(0.0328)	(0.0406)	(0.0380)			
Linst	−0.227	−0.966***	0.214			
	(0.326)	(0.295)	(0.364)			
L2.lno2		0.875***				
		(0.0623)				
L2.lspm			1.002***			
			(0.0537)			
Constant	−14.21	53.87***	52.32***			
	(16.40)	(13.62)	(15.86)			
Observations	51	51	51			
Number of id	4	4	4			

GDP per capita (GDP/P) is simply here denoted as gdpk; Standard errors in parentheses, ***P<0.01, **P<0.05, *P<0.1. Source: Computed by the researchers using Stata 13.1. GDP: Gross domestic product, EKC: Environmental Kuznets curve

Table 3: EKC turning point Southern Africa

Variables	Southern Africa			Turning points		
	lco2	lno2	lspm	lco2	lno2	lspm
L.lco2	0.885***					
	(0.0865)					
Lgdpk	0.835	−0.268	0.0390*			
	(0.770)	(1.470)	(0.240)			
$Lgdpk^2$	−0.0495	0.0239	−0.0270**	$7812.60	$5119.31	$492.67
	(0.0544)	(0.101)	(0.0159)			
Lpden	0.122	−0.0535	0.0342			
	(0.0755)	(0.150)	(0.0232)			
Ledu	0.227*	0.182*	−0.133*			
	(0.301)	(0.415)	(0.0779)			
Lenginvt	−0.0322**	0.00397	−0.00931*			
	(0.0161)	(0.0271)	(0.00500)			
Lfdi	0.0157*	0.0288	0.00756*			
	(0.0262)	(0.0541)	(0.00720)			
Linv	0.0170	0.00523	−0.00846			
	(0.0353)	(0.0619)	(0.00930)			
linst	0.134	−0.569	−0.00679			
	(0.265)	(0.556)	(0.0654)			
L2.lno2		0.988***				
		(0.110)				
L2.lspm			0.952***			
			(0.0924)			
Constant	−4.829	0.301	0.755			
	(3.800)	(6.264)	(0.973)			
Observations	84	84	84			
Number of id	7	7	7			

GDP per capita (GDP/P) is simply here denoted as gdpk; Standard errors in parentheses, ***P<0.01, **P<0.05, *P<0.1. Source: Computed by the researchers using Stata 13.1. GDP: Gross domestic product, EKC: Environmental Kuznets curve procedure uses a consistent estimator of the weighting matrix. The section gives adequate attention to various specifications and diagnosis test results in the interpretation of results. This is quite important because only satisfactory diagnosis and specification of test result gives credibility to coefficient estimates, the t-statistics and standard errors obtained in the estimation procedure. In addition, coefficient estimates were interpreted and espoused with practical economic reality, as such; possible transmission mechanisms among variables of interest are discussed.

In all equations estimated, the Arellano-Bond test for autocorrelation was applied to the differenced residuals in order to purge the unobserved and perfectly auto-correlated idiosyncratic errors. The results are reported as AR (1) and AR (2) in the lower panel of result tables. The significance of at least AR (1) indicates the validity of estimates. Also, a test of over-identifying restrictions of whether instruments as group, appear exogenous was conducted on the results. This is a test of instruments validity and focused on the comparison of the number of instruments used and the related number of parameters. The test is represented with Sargan and Hansen J tests. The probability values for these tests are presented in the lower panel of regression tables. In all cases, that is, the regression analysis reported, the null hypothesis that the population moment condition is valid is not rejected if the P values are significant. Also, the Hansen J test failed to reject the over-identifying restrictions, hence indicating the validity of instrument set.

The results in Tables 2 and 3 reveal evidences that EKC hypothesis could not be confirmed for Carbon emissions and Nitrous Oxide for the two sub-regions. Both the per capita income and per capita income squared show a positive relationship with the two emissions. The result agreed with Akpan and Chuku (2011), Osabuohien et al. (2014), Ogundipe et al. (2015) etc. The evidence implies that in the sub-regions especially Northern Africa emissions progressively grow with income with no turning point in sight. This reveals that income has not grown enough to instigate a declining trend in CO_2 and N_2O emissions. In North Africa, the average income required to turn around the EKC for both the CO_2 and N_2O is found to be \$8541.64 and \$7982, respectively. The corresponding values for Southern Africa are \$7812.60 and \$5119.31, respectively. The average income in the two sub-regions are far below this figures indicating that all things being equal the sub-regions will have to wait longer before attaining the EKC turning points for this pollutants.

Both CO_2 and N_2O emissions (particularly CO_2) are global and require a higher income level to acquire the requisite technology to combat. CO_2 emission comes from large volume gas flared from oil exploration, agricultural activities, transportation services, and manufacturing activities which are predominant in the sub-regions. Furthermore income inequality in the sub-regions may prolong the realisation of the EKC turning point. In fact, in most of the Southern Africa countries, there was no significant link between average income and emissions, even at the initial stages of development. This portrays the extent of income inequalities in Southern African economies, which implies that the economic growth processes yielding emissions does not translate into growth in average income for the citizens. In the absolute terms the EKC turning point figures suggest that Southern Africa will attain EKC faster. However, it should be emphasised with cautions as the attainment of EKC turning depends not only on the size of income but on other socio-economic factors. It is also noted that the average income to turn EKC round for N_2O is relatively lower particularly in Southern Africa. Nitrous oxide emission mainly comes from agricultural productivity and cattle grazing which are the major occupations in the sub-regions. Other sources include: the consumption of fossil fuels and bush burning. However the improved technology being witnessed in agricultural sector and supply of cleaner energy may have speed up the realisation of EKC turning point for N_2O. Although institution is stronger in the North; the lower population in the South coupled with higher investment in energy might have resulted in lower turning point income for both the CO2 and N_2O.

On the other hand GMM results affirmed the evidence supporting EKC for SPM in the two sub-regions. For this pollutant, the results indicate a positive relationship with income and negative relationship with income squared. This implies that with SPM, at the initial stage of development, pollution rises with increasing income but on reaching a certain threshold the relationship reverses and pollution starts to decline with increasing income. Thus an inverted U shaped curved is found for the pollutant in the two sub-regions. SPMs are local pollutants largely from bush burning, land digging, consumption of fossil fuel, disposal of refuse, among others (Akinyemi et al 2016; Akinyemi et al., 2017a). With a moderate increase in income individual is a able to migrate from the area of pollution to another with light or no pollution. Similar, being a local pollution SPM can easily checked by institution. Indeed in some Africa rural areas tradition, customs and local legislation forbid some activities that can generate large volume of SPM. Furthermore, the ability of people to curtail the emission of SPM increases faster with the increase in their income level compared with the other two pollutants. With increase in income people are able to afford the use of less polluting form of energy for example change from the use coal for cooking to the use of electric cooker.

The turning point for SPM in North Africa is \$628.5 while it is \$492.7 in Southern Africa. Just like other pollutants North Africa requires a larger income to turn EKC. The reasons for disparity in achieving SPM EKC turning points in the Africa Sub-regions can be attributed to a number of geographical economic, social and political factors. First, North Africa with the highest income level requirement for turning round the EKC has been experiencing one of the worst rates of climate fluctuations (IPCC, 2007a). The population of the region grew at a higher rate than that of other Sub-region between 1995 and 2015. This coupled with low level rate of literacy and high level of income inequality affect the speed of EKC towards the turning point. Population in North Africa is positively significant with SPM while it is not Southern Africa. The recent campaign on birth control and de-urbanisation at international level might had embraced and yielded the desired result in South Africa than in North Africa. In addition, North Africa region attracted the highest FDI during the period under consideration. Results show that FDI is positively significant on the emission in the region. FDI though not a direct cause of SPM emission but the spilt over has an indirect influence on the pollution. Although education is negatively significant with SPM in North Africa; the position is better in the South. Southern African education achieves better result in curtailing SPM and other pollution than in the North. This can be attributed to the fact that education in the Southern Africa is more rural based that of North.

In the similar vein, institution is positively related to SPM in North Africa while reverse is the case in Southern Africa. Institution in North Africa still contributes to the worsened of local pollutant while it reduces the emission in the South. This result suggests that impact of institution is not as strong in the rural areas of North Africa compared with Southern Africa. Investment in energy in North Africa has not been able to check the SPM emission. This may implies that rural dwellers in the region are yet to have adequate access to a neater form of energy or have not reach an income level whereby they mitigate the local pollutants.

The result is different in Southern Africa where investment in energy has a negative relationship with the SPM within 2005–2015. By this finding, it can be assumed that South Africa rural dwellers has a higher access to neater energy than their counterpart in the North and had attained income level needed to alleviate the effect of local pollutants. Finally, the general domestic investment is found to be positive related to SPM in North Africa but negatively related in Southern Africa. This suggests that North Africa domestic investment still contributes to pollution in the region. It may further implies that it is not the foreign investment alone that degrade the environment in this region and this Africa sub-region cannot assessed as being pollution haven. The National investment is not as *dirty* in the Southern Africa compared with the North. National investment in Southern Africa has a negative relationship with the SPM indication that the Africa sub-region is curtailing the local emissions by her green domestic investment. This can be attributed to the existence of a more improved technology in agricultural practices and grazing in Southern Africa than in North Africa.

6. CONCLUSION

The study assesses the impact of institutional quality in attaining feasible EKC turning points for three categories of emission in two Africa sub-regions – North Africa and Southern Africa. The EKC hypothesis could not be affirmed for CO_2 and N_2O emissions in the sub-regions' economies. As growth advances, pollutant emission is positively related to income; implying that increasing income could not mitigate pollution. This suggests that, is either average income has not grown enough to guarantee necessary abatement requirement or the share of income emanating from pollution production activities is not distributive enough to ensure that majority have enough proceeds to attain a healthier living method. This evidence as reflected in the gross neglect of the environment (especially the growth yielding environment) is predominant in African countries. A very ready instance is the case of countries that have abundant mineral resources, where the revenue obtained from the extractive activities have worsened the environment over time due to neglect and inadequate political will to enforce environmental regulatory compliance.

The Southern Africa requires lesser average income to turn EKC round for both global and local pollutants under investigation. The study posits that population density averts a contemporaneous positive influence on the global emissions in the two sub-regions. This is consistent with rational expectation that increasing the population per square kilometres enhances pressure on available human and economic resources, hence increasing the level of emissions. The expanding population in African cities increases human productive activities needed to sustain livelihood, as these activities such as agriculture, industry, construction, transport and household production expands the level of resulting pollutant emissions increases accordingly. However, the impact of pollution is worsened in North Africa compared with South Africa.

FDI contributes positively to the emissions in two Africa sub-regions but the contribution is more felt in the North than in the in the south. FDI inflows are predominantly in the dirty industries, mostly extractive industries which constitute the largest contributor to carbon emissions in most African economies. Investment in energy sector and education do not exert any contemporaneous influence on the global emissions in the North and Southern Africa. Institutional quality was found to be weak in controlling emissions in the sub-regions. This is even worst with CO2 emission in the sub-regions. This reflects the relatively weak level of institutional arrangement as regards, environmental management policies, enforcement of adherence to environmental regulation, and enforcing adoption of appropriate clean technologies in production and extraction processes and development of holistic environmental abatement measures. Unlike the CO_2 and NO_2 emissions, SPM affirmed the EKC hypothesis for two regional economies. However, it is found that Southern Africa attained the turning with lesser average income.

Based on the findings, study recommends an evenly spatial population distribution through direct government interventions geared towards opening up of new communities and cities in the African sub-regions. This will improve the level of dense population associated with some African cities and hence reduce undue pressure on available economic and natural resources; hence, dwindling the level of population. In most cases, the rural practice of federalism or geopolitical favouritism in citing economic resource centres should be jettison in favour of ensuring even population spread and reduce heavy population cluster and massive migration in search of economic opportunities which in turn lead to heavy pollution due to household and industrial activities. North Africa should look inward for the purpose of embracing the more the international birth control campaign. North and Southern Africa sub-regions should place more restrictions on the activities of foreign investors with pollution laden industries. There is need to develop a strong and responsive institutional framework that ensures that dirty industries bare the full cost of their negative externalities and responsible to their environment. Over time, this has been a serious impediment to attaining a healthier environment in African cities. Multinational companies believe they can always manipulate existing policies via bribe instead of investing heavily on environmental clean-up. There is hence need for stricter environmental regulations to check Pollution Haven in the sub-regions and implementation of self-sustaining, self-regulating institutional policies void of undue interventions.

Similarly, there is need for planned, continuous and strategic investment in the energy sector in the two regional African economies. A lot needs to be done along this line in the North Africa. In the same manner, there is need to consciously inculcate environment care and hygiene living in the basic schooling curriculum in order to propagate environmental consciousness in African cities. This will expose the populace to basic environmental care and hence reduce the level of abuse and pollution. Education (especially for the rural dwellers) needs to be fortified particularly in the North. This will ensure the realisation of EKC faster for the pollutions particularly the local pollutants. In addition this study recommends more equitable distribution of income in the Africa sub-regions. Southern Africa will need to do more along this line. Prior to the recent economic downturn in the sub-regions, the last three decades has seen the African economies exhibiting high growth trends with its economies among the fastest growing economies in the world. In spite of this, social and economic indicators have not improved in the sub-regions, keeping average income relatively low while absolute economic returns has actually increased in its real terms. Hence, there is the need for a redistributive policy that ensures a fair income distribution in order to turn the EKC faster in the sub-regions.

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REFERENCES

Acemoglu, D., Simon, J. (2005), Unbundling institutions. Journal of Political Economy, 113(5), 949-995.

Agarwal, R.N. (2012), Economic globalization, growth and the environment-Testing of environmental Kuznets curve hypothesis for Malaysia. Journal of Business Finance Affair, 1(2), 1-104.

Akinyemi, O., Alege, P., Ajayi, O., Okdoua, H. (2017a), Energy pricing policy and environmental quality in Nigeria: A dynamic computable general equilibrium approach. International Journal of Energy Economics and Policy, 7(1), 268-276.

Akinyemi, O., Alege, P., Osabuohien, E., Ogundipe, A. (2016), Energy security and the green growth agenda in Africa: Exploring trade-offs and synergies. Mediterranean Journal of Social Sciences, 7(1), 375-382.

Akinyemi, O., Osabuohien, E., Alege, P., Ogundipe, A. (2017b), Energy security, trade and transition to green economy in Africa. International Journal of Energy Economics and Policy, 7(3), 127-136.

Akpan, U.F., Chuku, A. (2011), Economic Growth and Environmental Degradation in Nigeria: Beyond the Environmental Kuznets Curve. MPRA Paper No 31241. Available from: http//www.mpra.ub.uni-muenchen.de/31241.

Alam, M.R., Kiterage, E., Bizuayehu, B. (2017), Government effectiveness and economic growth. Economic Bulletin, 37(1), 222-227.

Al-Ayouty, I., Hassaballa, H., Rizk, R. (2017), Clean manufacturing industries and environmental quality: The case of Egypt. Environmental Development, 21, 19-25.

Alege, P.O., Ogundipe, A.A. (2013), Environmental quality and economic growth in Nigeria: A fractional co-integration analysis. International Journal of Development and Sustainability, 2(2), 580-596.

Aliyu, I.J., Baba, J.M., Suleiman, Y.M. (2015), Effect of environmental consciousness in public healthcare institution and community awareness in Mokwa local government area of Niger State Nigeria. Journal of Environment, 2(1), 1-4.

Ananthan, D. (1996), Poverty and Environmental Degradation: A Literature Review and Analysis. Greed Working Paper Series, No 8, International Institute for Environmental and Development, London Institute for Environmental Studies.

Aron, J. (2000), Growth and Institutions a review of the Evidence. The World Bank Research Observer, 15(1), 99-135.

Arellano, M., Bond, S. (1991), Some tests of specification for panel data. Monte-Carlo evidence and in application to employment equations. The Review of Economic Studies, 58, 277-297.

Asthana, D.K., Asthana, M. (2006), A Text Book of Environmental Studies. New Delhi: S. Chand and Company.

Bhattarai, M., Hamming, M. (2001), Institutions and the environmental kuznets curve for deforestation: A cross-country analysis for Latin America, Africa and Asia. World Development, 29(6), 995-1010.

Blundel, R., Bond, S. (1998), Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, 87, 115-145.

Blundell, R.W., Bond, S.R., Windmeijer, F. (2000), Estimation in dynamic panel data models: Improving on the performance of the standard GMM estimator. In: Baltagi, B.H., editor. Non - Stationery Panels, Panel Cointegration and Dynamic Panels, Advances in Econometrics. Vol. 15. Amsterdam: JAI Press, Elsevier Science.

Chang, C.C. (2005), Electoral incentives for political corruption under open-list proportional representation. Journal of Politics, 67(3), 716-730.

Chu, K.Y. (2003), Collective values, behavioural norms and rules: Building institutions for economic growth and poverty reduction. In: van der Hoeven, R., Shorrocks, A., editor. Perspectives on Growth and Poverty. Tokyo: United Nations University Press.

Coarse, R.H. (1937), The Nature of the firm. Economical, New Series, 4(16), 368 405.

Cole, J.H. (2003), The Contribution of economic freedom to world economic growth. Cato Journal, 33, 189-198.

Davis, K.E. (2010), Forthcoming in Institutions and Economic Performance. Cheltenham, UK: Edward Eglar, New York University.

De Bruyn, S.M., Van Den Bergh, J.C., Opschoor, J.B. (1998), Economic growth and emission - Reconsidering the empirical basis of environmental Kuznets and curve. Ecological Economics, 25(2), 161-175.

Deacon, R. (1999), The Political Economy of Environmental Development Relationship: University of California. Santa Barbara: Department of Economic, Preliminary Frame Work Working Paper.

Environmental Resources Management. (2009), Impact of Climate Change on Nigeria Economy: Final Export Department for International Development.

Goklany, I.M. (1999), Cleaning the Air: The Real of the War on Air Pollution. Washington, DC: Cato Institution.

Grossman, G.M., Krueger, A.B. (1991), Environmental Impact of North American Free Trade Agreement. Working Paper 3914. Cambridge, MA: National Bureau of Economic Research.

Habassaballa, H. (2013), Environment and foreign direct investment. policy implications for developing countries. Journal of Emerging Issues in Economics, Finance and Banking, 1(2), 75-106.

Haliman, B., Elsadig, M.A., Mizan, H. (2013), Carbon dioxide quality of life and economic growth in east Asian 8. Journal of Asian Behavioral Studies, 3(8), 1-42.

Intergovernmental Panel on Climate Change-IPCC. (2007), Then Cite As: Change to Intergovernmental Panel on Climate Change-IPCC Climate Change 2007 - The Physical Basis: Contribution of Working Group 1 to the 4th Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.

Itochoko, M.M.M., Pierre, C.I. (2017), The effect on Economic growth of natural resources in Sub-Sahara Africa; 'Does the quality of institutions matter'. Economic Bulletin, 37(1), 248-263.

Jing, Z. (2008), Foreign Direct Investment, Governance, and the Environment in China: Regional Dimensions. An Unpublished Ph.D. Thesis Submitted to Department of Economics, School of Social Sciences, and University of Birmingham.

Khadarro, A.J., Sultan, F. (2013), Economic growth and carbon emission in Mauritius; an econometric analysis in the context of Mauricelle Durable project. African Journal of Economic and Sustainable Development, 2(3), 266-278.

Knack, S., Keefer, P. (1995), Institutions and economic performance: Cross country test using alternative institutional measures. Economic of Politics, 7, 207-227.

Kshetri, N. (2012), Privacy and security issues in cloud computing: The role of institutions and institutional evolution, Telecommunication Policy, 37(5), 372-386.

Kugbee, S.J., Insa, B. (2015), Fiscal sustainability in Ghanaian Economy; A Fiscal Reaction Function. Economy, 2(1), 16-20.

Melanie, S.M. (2007), Integrated Financial Supervision: An Institutional Perspective for the Philippines. ADBI Discussion Paper 81. Tokyo: Asian Development Bank Institute. Available from: http://www.adbi.org/discussionPaper/2007/10/25/2381.Integrated.financial.supervision.

Ming-Feng, H., Daigee, S. (2006), Economic growth and environmental kuznets curve in Taiwan-A simultaneity model analysis. In: Boldrin, M., editor. Long Run Growth and Economic Development; From Theory to Empirics. UK: Edward Elgar.

Nondo, C., Kahsai, M.S., Hailu, Y.G. (2016), Does Institutional quality matters in foreign direct investment? Evidence from Sub-Saharan African countries. African Journal of Economic and Sustainable Development, 1, 12-30.

Norton, S. (2002), Population Growth, Economic Freedom and the Rule of Law. PERC Policy Series No. PS-24. Bozeman, MT: PERC, February. Available from: http://www.perc.org/publications/policyseries/economic-freedom.php?s=2. [Last retrieved on 2017 May 27].

North, D. (1994), Economic Performance through Time. American Economic Review, 84(3), 359-68.

Ogundipe, A.A., Olurinola, I.O., Odebiyi, J.T. (2015), Examining the validity of EKC in Western Africa: Different pollutant option. Environmental Management and Sustainable Development, 4(2), 69-84.

Oliver, C. (1992), The antecedents of de-institutionalization. Organizational Studies, 13, 563-588.

Olusola, O.J. (2016), The impact of physical and human capital development on economic growth in developing countries; A comparative panel data approach. Economy, 3(1), 1-18.

Osabuohien, E.S., Efobi, R.U., Gitau, M.W. (2013), External intrusion, internal tragedy: Environmental pollution and multinational corporations in sub-sahara Africa. In: Principles and Strategies to Balance Ethical, Social and Environmental concerns with corporate requirement Advances in Sustainability and Environmental Justice. Vol. 13. United Kingdom: Emerald Group Publishing Limited. p93-118.

Osabuohien, E.S., Efobi, U.R., Gitau, C.M.W. (2014), Beyond the environmental kuznets curve in Africa: Evidence from panel cointegration. Journal of Environmental Policy and Planning, 16(4), 517-538.

Panayotou, T. (1997), Demystifying the environmental kuznets curve: Turning a black box into a policy tool. Environment and Development Economic, 2(4), 465-484.

Pao, H.T., Tsai, C.M. (2011), Modelling and forecasting the CO2 emissions, energy consumption and economic growth in Brazil. Energy, 36, 2450-2458.

Pesaran, M.H., Shin, Y., Smith, R.P. (1999), Pooled mean group estimation of dynamic heterogenous panels. American Statistical Association, 94(446), 621-634.

Postner, E.A., Sunstelin, C.R. (2007), Law and Happiness Chicago. Chicago, IL: University of Chicago press.

Powell, B. (2003), Economic freedom and growth: The case of Celtic Tiger. Journal of Private Enterprise, 21, 8-28.

Quin, X.D. (1998), Economic Development and Environment Quality: A Look at the Environmental Kuznets Curve-Dissertation, Clemson University.

Rauscher, M. (2005), International trade, foreign investment, and the environment. In: Maler, K.G., Vincent, J., editors. Handbook of Environmental Economic. Vol. 3. Amsterdam: Elsevier (North-Holland Handbooks in Economics).

Shahbaz, M. (2012), Multi Variate Granger Causality between Co2 Emission, Energy Intensity, Financial Development and Economic Growth. Evidence from Portugal. Munich Personal RePEC Archive (MPRA) Paper No. 37774.

Sileem, H.H. (2015), Economics. The European Journal of Sustainable Development, 4(2), 259-268.

United Nations Research Institute for Social Development (UNRISD). (1994), Environmental Degradation and Social Integration: UNIRSD Briefing Paper No. 3. World Summit for Social Development.

Victor, U.O. (2017), Monetary and Fiscal Policy Coordination in Nigeria. A set of Theoretic Approach. Academic Journal of Economic Studies, 3(1), 45-58.

Williamson, J.G. (1998), Globalization, Labour Market and Policy Backlash in the past. The Journal of Economic Perspectives, 12(4), 51-57.

World Bank. (2016a), World Development Indicators. Washington DC: World Bank.

World Bank. (2016b), WGI (2016) World Governance Indicators. Washington DC: World Bank.

World Health Organization. (2013), Regional Burden of Disease Due to Indoor Air Pollution. Available from: http://www.who.int/indoor/health impacts/burden-regional/en. [Last accessed on 2017 May 27].