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Attaining EKC in Africa: Why Institutions Really Matter

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Abstract: The study examines the impact of institutions on growth and environmental quality relationship in Africa using a static panel approach for the period 1996-2014. It disaggregates African economies into three categories based on World Bank framework. These categories include: poor institutions fair institutions and good institutions. The empirical result indicates the realization of the EKC hypothesis in African economies with good and fair institutions while no feasible turning point threshold could be ascertain for economies with poor institutions. Similarly, our result suggests that environmental quality was more responsive to income growth in economies with good institutions, implying that with African economies with sound institutions tends to turn the EKC faster.

Key words: Environmental degradation, growth institutions, Africa, economies, quality

INTRODUCTION

African economies has been witnessing steady growth in the past three decades but this has not been without negative impact on environmental quality. Present national and global efforts toward ensuring inclusive economic growth has been with a recourse to sustainable environment. The challenge of balancing the immediate need for survival with the long run sustainability of the environment remains a critical issue for African economies. The quest for this balance results in finding an answer to certain fundamental questions which include 'What has been the magnitude of the impact of economic growth on the pace of environmental degradation? Would the immediate dirty growth proceeds in Africa guarantee access to cleaner and safer environment in the long-run? Will African countries able to grow out of environmental degradation. Despite several studies addressing growth and pollution interrelationships in Africa (Alege and Ogundipe, 2015; Omojolaibi, 2010; Osabuohien and Efobi, 2013) these questions still demanda satisfactory answer.

Available literature on growth and environmental degradation nexus identified two strands of theories; Environmental Kuznets Curve (EKC) theory and the Pollution Haven Hypothesis (PHH). The EKC posits that as economic activities increase, environmental degradation rises, reach a certain threshold and then decline with the increase in economic activities. This depicts an inverted U-shape curve (Grossman and Krueger 1991a, b; Ogundipe *et al*., 2014). The empirical evidence on EKC for developing African countries produced mixed results while few like Bhattarai and Hamming (2001) and Osabuohien and Efobi (2013) found an existence of inverted U-shaped EKC for carbon-dioxide (CO_2) emission, others such as Akpan and Chuku and Oshin and Ogundipe do not. A number of these studies were interested in validating or refuting the existence of EKC (Omisakin, 2009; Osabuohien and Efobi, 2014), merely emphasizing the outcome of some econometric gymnastics (Panayotou, 1993; Omojolaibi, 2010; Osabuohien and Efobi, 2014; Alege and Ogundipe, 2015) and considered mainly empirical validation of an earlier studies while a few others examined how several pollutants respond to income growth (Ogundipe *et al*., 2014a-c). These observed weaknesses resulted in conflicting evidences as the existing empirical findings differ based on the choice of control variables, estimation techniques/bias and data used. This empirical dichotomy left the fundamental issue and question unattended. This study examines an important question regardingwhy average income has not grown enough to secure sustainable environment in spite of the consistent and impressive growth statistics in the region.

The study investigates the EKC hypothesisin the light of institutional strength in Africa. The available extant studies controlled for factors such as population, trade, agriculture, economic structure and manufacturing but failed to adequately account for heterogeneities in institutions among African countries. Examining this differences in instructional strength is expedient as the quality of institutions determines how equitable growth proceeds are distributed which ultimately helps to turn

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the EKC faster. The quality of institution becomes very important for Africa economies to attain the EKC turning point threshold fast. In the same vain institutional quality cannot be neglected if developing nations will solve the problem of pollution haven. The realization of the EKC hypothesis and the green growth experience in developed economies cannot be disconnected from the quality of the institutions in place (Galeotti, 2003; Bhattarai and Hamming, 2001).

Institution quality has been recognized as an important factor in the process of balancing the economic growth with environmental degradation. Panayotou (1993) explains that it is not higher income per se that bring about environmental improvement but the supply response and policy responsiveness to the growing demand for environmental quality through the enactment of environmental legislation. Similarly, Torras and Boyce maintained that changes in the technology towards being cleaner and safer for the environment could be induced by a more effective institutional policy measures. In the words of North institution is seen as the humanly devised constraints that shape human behaviours while a few others conceive institution as legal, economic, cultural, political and social system (Rodrik, 2000). Also, Glaeser simply consider institution as a constraint that is reasonably permanent or durable. However, this study align with researchers such as North (1990), Grief (2006), Rogar (2009) and Davis (2010) who perceives institution as rules, laws, regulation and policies with their enforcement processes.

The remaining part of the study is structured as follows; the literature review-which describe theoretical link between institutions and environmental quality occupies section two, sections three outlined the conceptual framework, section four contains the research methodology, the discussion of result is presented in fifth section and the last section concludes with some policy recommendations.

Literature review

Why institutions matter: The degeneration of institutions in environmental management causes widespread challenges of the environment. Weak environmental laws, regulations and policies, coupled with lack of financial and human resources for their implementation and enforcement create an institutional vacuum that result to increase in environmental degradation. Ananthan established a circle between institutions and environmental degradation and it was pointed out that asides poverty, power, wealth and greed; institutional failure is responsible for environmental degradation. The author maintained that environmental problems must be understood as part of the larger framework as an integral part of the social integration and must be addressed from that perspective. UNRISD explained that the combined efforts of supportive institutions both at local, national and international levels are needed in controlling environmental degradation at local level. Treating the various dimensions of environmental degradation issues in isolation will obscure as much as it reveals. Therefore, UNRISD argued that the strengths and weaknesses of the major types of policy approaches to environmental degradation and the complementary and contradictions between them must be assessed separately in each context.

Linking environmental degradation to poverty, Ananthan posits that policies focused towards the mitigation of indigenous poverty will have limited impact if the primary force that is institutional failure is still present. He stated that exogenous poverty causes environmental degradation and the best solution would call for the adoption of policies which internalize the environmental externalities or alternatively government insistence on standardized environmental policy like 'Polluter Pay Principle' (PPP) among trading partners. UNRISD established three policy responses to environmental degradation. The first is "conservationism", this policy response is based on the idea that human activity is detrimental to natural environment and that nature should be conserved by keeping areas from human contact. This idea has been influencing environmental policy since the mid-19th century, when the first USA national parks were established. The body identified regulations limiting or prohibiting the exploitation of certain animal or plant species and recommended that environmental protection measures should be carried out in conjunction with productive activities and the prohibition of various activities that contribute to air, water and soil pollutions as parts of nature conserving approach.

Second, is the Primary Environmental Care (PEC), this approach rests on the assumption that it is essential to focus on the grass roots or community level if sustainable growth will be achievable. PEC stresses the empowerment of communities in locating the sources of many environmental problems curtailing their ability in adequately controlling their resources. It directs attention to the external factors that inhibit sustainable local level uses of natural resources and emphasized the fact that binding constraints limiting the ability of people to successfully manage resources is not without appropriate techniques or lack of understanding of the importance of

the environment but failure to provide opportunities and means for the people to put into the practice the doctrine of "respect for the environment". This is line with UNRISD submission that the PEC implementation depends on institutional adaptability which is crucial in the context of rapid social and environmental change.

The third is the Monetary Cost-Benefit Approach. It is premised on the point that those who damage the environment should be forced to bear the full cost of their activities as this makes environmental exploitation become unprofitable and thereby slowing down the pace of environmental degradation. This is refers to as the doctrine of internalising the externalities in the words of UNRISD. This doctrine has brought about the idea of setting up of "markets" for pollution whereby countries could trade in their quotas of clear air or water. From the survey of literature contacted on issues relating to environmental degradation and institution, it is noticed that interrelationship between environmental degradation and institution can flow from both direction. This implies that institution can influence environmental degradation and at the same time environmental degradation can influence institutions.

Environmental degradation can bring about stringent legislations and stringent legislations have the capacity to influence environmental degradation. In the face of threatened environmental degradation for example, stringent environment protection, laws, regulations and policies can bring about effective control of environmental degradation and pave the way for easy abatement, adaptation and mitigation. Since institution is dynamic, the improved environmental quality may result into relaxing environmental laws, regulations and policies and this may in turn result into increase environmental degradation calling for stricter environmental measures. It should be noted that the length of the cycle will depend on numbers of factors such as, the institutional strength, the level of environmental degradation or improvement and the environmental variable (s) involved.

In the recent years, attempts are being made by authors to capture the role of institutions in the model of environmental degradation and growth. The general agreement among authors is that developing countries are in the ascending portion of the EKC and institutional intervention can hasten or slow down the "race to the top". In the same vein, it has also been argued that many developing countries are pollution haven due to lax environmental policies. Therefore, it has been advocated by authors like Irna (2002) and Omojolaibi (2010), Akpan and Chuku (2011) among others that strong and effective institutions should be developed so that policies that are justified on economic grounds can complement those for environmental protection. In the literature, the result of the analysis of the model including institutions and environmental quality factors varies depending on the variables of institutional quality and environmental degradation employed. Irna found that better environmental management is statistically significant and associated with reduction in pollution levels. His results showed that one unit increase in environmental regulation index causes 0.03% reduction in sulphur dioxide emission per capita in Ukraine within the period of analysis.

Chen disagree with Zhao on the use of current investment completed in the treatment of industrial pollution as a measure of stringency of environmental policy and used shares of industrial sulphur dioxide, soot dust and soot removed as proxies for the intensity of government regulation in industrial sulphur dioxide, dust and soot. For the intensity of government regulation in industrial waste water, the share of Industrial waste water that complied with standard discharge channels was exploited and for industrial solid waste, the ratio of industrial solid waste treated was used. Chen found that environmental policies play a significant role in reducing emission of the pollutants except for industrial solid wastes.

The empirical analysis of Bhattarai and Hamming (2001) shows that government institutions are negatively correlated with the rate of deforestation while environmental policies such as stricter environmental regulations play a significant role in decreasing pollution. Alege and Ogundipe (2015) controlled for institutions using corruption index as measure of institutional quality. The result of the analysis of their model show that control of corruption exerts an inelastic impact on Co_2 emission, implying that improvements in the institutional quality reduces the level of Carbon dioxide emissions in Nigeria. Also, Posu used variables of economic liberalization; FDI, trade intensity and financial development to proxy institutions and employed Co_2 emission as a measure of environmental quality. The time series adopted data covers the period between 1970 and 2012 and the study found that, contrary to the PHH increase in Co_2 emissions or the absence of stringent regulation to check environmental pollutions was not a major factor that attract FDI into Nigeria. It hence implies that foreign investment decisions are dependent on several factors other than laxity in environmental regulations.

From the review of extant studies in this sub-section, it is discovered that, although many authors recognize the important role of institution in the spate of environmental degradation and control for it in their models, certain areas

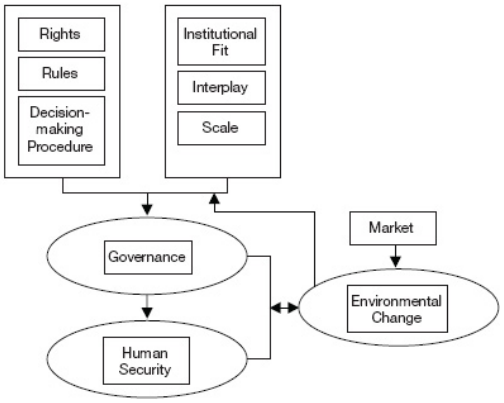

Fig. 1: Interaction between institution and environmental quality

still need to be further explored. There is the need to disaggregate African countries based on the strength of their institutions and examine how this affect the realization of EKC hypothesis in each category. Hence, this study disaggregates African economies into three; comprising those with good institutions, fair institutions and weak institutions.

Conceptual framework: Institutions could be contextualized as a cluster of rights, rules and decision-making procedures occurring at all levels of social organisations and with an emphasis on environmental and resource regimes. The role institution play causes and confronts environmental change. Human security is achieved when individuals and communities have the options necessary to end, mitigate or adapt to threats to their human, environmental and social rights have the capacity and freedom to exercise these options and actively participate in pursuing these options.

Basically, the literature has witnessed contradictory ideas and empirical findings on the effect of institutions on environmental degradation. One strand believes that institutions (democracy and control of corruption) improve environmental quality while others opined that institution may worsen environmental quality as economies with strong institutions attract investment which hampers environmental quality.

The study by Li and Reuveny, Bernauer and Koubi, Hosseini and Kaneko surveyed the literature about the effect of institutions on environmental policy. As rightly indicated in Fig. 1, these studies identified that political rights and freedom of information promote the cause of environmental interest groups which raise public awareness and encourage environmental legislation. Kotov and Nikitina opines that electoral accountability and ability of groups to mobilize make democracies more responsive to the environmental needs of the public. Similarly, Weiss and Jacobsen and Berge suggests that democracies institutions respect the rule of law and human life and also supports economic freedom and market economies (sustainable growth) which in turn promote environmental quality.

From Fig. 1, economic growth influences environmental degradation (EKC hypothesis). The influence of institution can hasten the movement of the curve to reach the turning point faster and thus bringing about the desire sustainable growth. Strong institutional quality can also impact on economic growth and environmental degradation by ensuring that location or relocation of dirty industries are appropriately put under control thereby guiding against pollution haven. Moreover institutional intervention can bring about rapid economic growth which in turn can result into increase in rate of environmental degradation that can again be checked by the intervention of institution. Similarlym increase in environmental degradation resulting from growth beckons on institutional strength to pave the way for green growth in order to achieve the goal of sustainable development. In nutshell institutional strength occupying the apex of the triangular relationship significantly controls the relationship between environmental degradation and economic growth. This study in departure from many other past studies, therefore carries out an in depth analysis of the role of institutions on the relationship among economic growth and environmental degradation factors.

MATERIALS AND METHODS

Model specification: The study adopts a standard EKC model espoused by Grossman and Krueger (1994) and adopted by Ogundipe *et al*. (2014a, b). The econometric specification assumes a functional relationship between indicators of environmental quality and its determinants. The basic EKC equation is described as thus:

$$\ln ED_{it} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 (\ln Y_{it})^2 + \beta_3 \ln edu_{it} + \beta_4 \ln opn_{it} + \beta_5 \ln pden_{it} + \beta_6 inst_{it} + u_{it}$$

Where:

Ed_{it} = The indicator of environmental degradation captured using carbon dioxide emissions (metric tons per capita)

Y_{it} = GDP per capita (constant 2005 US$)

edu_{it} = An indicator of literacy rate captured by total school enrolment

opn_{it} = The degree of trade openness

du_{it} = Population density (people per sq. km of land area)

$inst_{it}$ = An indicator of institutional strengthen (a composite index of four quality indicators by WGI)

u_{it} = The random error term

Estimation technique: The study adopts an ordinary pooled least square regression and static panel data analysis using the fixed effect and random effect regression. This is necessitated by the scope of the research studies which includes fifty-three entities (African economies) over time period of 1996-2014. The static panel regression analysis is preferable to the pooled OLS regression because the former accounts for specific unique characteristics across entities. The fixed effect specification controls for the influence of cross-sectional bias on the outcome variable that is it removes the effect of time invariant characteristics from the predictor variable (Alege and Ogundipe, 2015). Alternatively, the random effect assumes that biases across entities are random and uncorrected with the independent variables. The choice of the most appropriate and reliable model depends on the outcome of the Hausman test.

Data sources and measurements: The data for the empirical analysis were sourced from the world development indicators 2015 published by the World Bank. The data for institutional variables (control of corruption, government effectiveness, rule of law and regulatory quality) were obtained from the world governance indicators 2015. The summary of data sources and measurements are indicated below.

Table 1: Data sources and measurements

Variables	Description	Measurements	Sources
ED	Environmental degradation captured using CO_2 emissions	Metric tons per capita	WDI, 2015
Y	GDP per capita	Constant 2005 US$	WDI, 2015
Edu	Literacy rate captured using school enrolment	rule percentage	WDI, 2015
Opn	Trade openness captured using trade flows divided by GDP.(Exports+imports)/GDP	Rate	WDI, 2015
Pden	Population density captured by population per square kilometre of land area	percentage	WDI, 2015
Inst	Institutional strengthen captured, using a composite index of four institutional variables-control of government effectiveness and regulatory quality	Index	WGI, 2015

Table 2: EKC Regression (controlling for institution)

Variables	OLS	Fixed effect	Random effect
Lgdpk	0.909***	1.399***	-0.497***
	(0.0736)	(0.254)	(0.134)
lgdpk2	-0.00229	-0.00806	0.0264***
	(0.00153)	(0.00562)	(0.00331)
Ledu	1.340***	-0.137**	-0.175***
	(0.105)	(0.0618)	(0.0624)
Lopn	-0.827***	0.0330	-0.157***
	(0.0374)	(0.0283)	(0.0278)
Lpden	-0.119***	-0.985***	-0.0665
	(0.0248)	(0.136)	(0.0787)
Inst	0.167***	-0.333***	-0.199***
	(0.0619)	(0.0434)	(0.0469)
Constant	-13.63***	-24.05***	0.194
	(0.680)	(2.873)	(1.349)
Observations	784	784	784
R^2	0.689	0.513	
Number of id		49	49
Hausman		6.01	

Standard errors in parentheses; ***p<0.01; **p<0.05; *p<0.1

RESULTS AND DISCUSSION

Table 1 presents an empirical result for EKC model in Africa. The table comprises the ordinary least square regression results. In addition in order to control for specific time invariant and random characteristics associated with panel data, the fixed and random effect models were estimated. In an attempt to arrive at the most efficient and reliable model, the Hausman test was adopted. The Hausman test with the Chi-square of 6.01 and probability of 0.027 failed to negate the alternative hypothesis and thus suggests that the fixed effect model is most efficient. The fixed effect specification expresses the standard EKC model and controls for the role of institutional quality. The result suggests that at initial stage of development, emission is a rising function of income but the insignificance of the income squared makes the realization of the turning point threshold ambiguous. It thus, implies that we could not establish the EKC hypothesis for Africa. This readily signifies that average income has not grown to the threshold necessary to abate pollutions, adopt cleaner environmental and social services. This is not unconnected with the reality that over 80% of Sub-Saharan population still rely on dirty energy sources (mostly traditional biomass and fossil fuel) for cooking, heating and lighting purposes.

On the other hand, education, population density and institutions impact significantly on carbon emissions in Africa with population density exerting the largest influence. A 100% change in education, population density and institution cause about 13.7 98.5and 33.3% change in carbon emissions. This implies that literacy improves the awareness and demand for cleaner environment. Moreso, a densely populated society tends to be susceptible to environmental contamination especially in Africa where environmental abatement measures are weak, dirty energy drives the growth processes and where the bulk of both commercial and residential energy sources are alternatively provided.

Table 2: EKC Regression (disaggregated economies)

	Good institution			Fair institution			Poor institution		
Variables	OLS	FE	RE	OLS	FE	RE	OLS	FE	RE
Lgdpk	42.00***	46.59***	42.00***	0.776***	1.806***	-0.322*	0.750***	0.771*	-0.670***
	(5.634)	(6.162)	(5.634)	(0.0829)	(0.301)	(0.179)	(0.115)	(0.422)	(0.186)
lgdpk2	-0.909***	-1.017***	-0.909***	0.000706	-0.0252***	0.0152***	0.00313	0.00814	0.0357***
	(0.121)	(0.135)	(0.121)	(0.00176)	(0.00642)	(0.00435)	(0.00247)	(0.00947)	(0.00460)
ledu	-0.165	0.231	-0.165	0.949***	0.0145	0.0385	1.842***	-0.275**	-0.276***
	(0.483)	(0.529)	(0.483)	(0.108)	(0.0643)	(0.0665)	(0.161)	(0.107)	(0.103)
lopn	0.174	0.233*	0.174	-0.865***	0.0797**	-0.0848**	-0.772***	-0.0472	-0.160***
	(0.135)	(0.136)	(0.135)	(0.0394)	(0.0372)	(0.0358)	(0.0633)	(0.0415)	(0.0408)
lpden	0.0701***	0.873*	0.0701***	-0.141***	-0.684***	0.0424	-0.131***	-0.745***	-0.197
	(0.0233)	(0.490)	(0.0233)	(0.0290)	(0.164)	(0.0944)	(0.0454)	(0.204)	(0.131)
Constant	-486.0***	-540.3***	-486.0***	-9.667***	-26.87***	-0.427	-16.18***	-17.11***	0.359
	(64.54)	(71.06)	(64.54)	(0.793)	(3.479)	(1.814)	(0.960)	(4.659)	(1.857)
Observations	38	38	38	551	551	551	342	342	342
R^2	0.926	0.925		0.727	0.342		0.655	0.599	
Number of id		2	2		29	29		18	18
Hausman		3.21			7.91			2.92	

Standard errors in parentheses; ***p<0.01; **p<0.05; *p<0.1

Table 2 presents the estimation results disaggregating Africa economies according to the strength of their institutions. Since the quality of domestic institutional arrangement drives the commitment towards attaining sustainable environment, it becomes expedient to categorize Africa economies according to their institution quality and assess how this influences the realization of a possible turning point. In this wise, Africa economies are classified thus economies with good institutions economies with fair institutions and economies with poor institutions. We arrive at this classification using the World Bank (WGI) framework, our institution quality is captured using the average of four indicators of the strength of institution as shown by WGI. This include control of corruption, regulatory quality, government effectiveness and rule of law. The WGI set a boundary of -2.5 to +2.5 to represent extremely weak institution to a very strong institution. For this study, we modify the boundaries to capture three categories and reflect the unique nature of African economies. The categories include: -2.5-1 (poor institution African economies in this category include: Angola, Burundi, Central Africa Republic, Comoros, Cote d'Ivoire, Congo, Equatorial Guinea, Eritrea, Guinea, Guinea-Bissau, Liberia, Libya, Nigeria, Dr. Congo, Sierra Leone, Somalia, Sudan, Togo and Zimbabwe.), -0.9-+1 (fair institution Africa economies in this category include: Algeria, Benin, Burkina Faso, Cameroon, Cape Verde, Djibouti, Egypt, Ethiopia, Gabon, Gambia, Ghana, Kenya, Lesotho Madagascar, Malawi,Mali, Mauritania, Morocco, Mozambique, Namibia, Niger, Rwanda, Sao tome, Senegal, Seychelles, South Africa, Swaziland, Tanzania, Tunisia, Uganda, ambia)and +1.1-+1.5 (good institution African economiesin this category include: Botswana and Mauritius.

The evidence from the estimated model reveals the realization of the EKC hypothesis in economies with good and fair institutions whereas; pollution remains a rising function of income in economies with poor institutions. The finding is consistent with Kind who found a positive simple correlation between the index of democratic institutions and environmental quality.

Interesting, a vast number of nations with poor institutions in Africa are high income-earning resource-rich economies. In spite, of the consistent growth, average income has not grown enough to guarantee access to clean and sustainable environment. This reflects the depth of poverty and inequality as a number of these economies (Sub-Saharan countries) has grown consistently by over 5% for the past two decades. It is necessary to note that though, EKC was attained for economies with good and fair institutions but the turning point was more responsive in category A (good institution) than for economies with fair institution (Table 3).

CONCLUSION

The relationship between institutional changes and increased prosperity is another complex but little analysed topic within the scope of environmental analysis. The relationship between growth and environmental quality is not straightforward but involves a complex feedback mechanism passing through various institutional channels affecting both market and political forces. Institutional forces affect EKC relationship particularly in low-income countries; this thus implies that wider literacy, greater political liberties and civil rights could positively affect environmental quality. For instance, corruption

affects environmental regulation and enforcement negatively. Greater corruptibility reduces the stringency of environmental policy by shifting the governments' relative weight away from welfare toward bribes, making it cheaper to purchase government influence. In the words of Esty corruption contributes to lax enforcement of environmental regulations and an ability on the part of producers and consumers to evade responsibility for the environmental harms they cause.

The study examines the role of institutions on income-pollution nexus in Africa using static panel data approach for the period 1996-2014. The study disaggregated African economies into three categories based on their institutional strength. The classification partly follows the World Bank framework with slight moderation and structured thus economies with poor institutions, economies with fair institutions and economies with good institutions. The regression result shows that African economies with good institutions promptly attain the EKC than others while those with poor institutions failed to confirm the EKC hypothesis. This suggests institutions play a significant role in addressing and combating global and point pollutants, hereby, ensuring sustainable environment.

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