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Natural Resource Rents, Institutional Quality, and Environmental Degradation in Resource-Rich Sub-Saharan African Countries

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Abstract: Environmental degradation concerns are increasing worldwide. Moreover, in sub-Saharan African countries, these concerns are dominant because of an abundance of natural resources and exhaustion of these natural resources that tend to cause carbon emissions. This has created a huge interest among academics in investigating the relationship between natural resources, institutional quality, and environmental degradation. Since the sub-Saharan countries are resource-rich, the current study investigates how the natural resource rents and institutional quality impacted environmental degradation in selected sub-Saharan African countries from 1994 to 2020. Through employing the GMM estimation technique, the findings show that natural rents are positively linked with environmental degradation. This is closely related to the Environmental Kuznets Curve (EKC) hypothesis, which stipulates that environmental degradation worsens at the initial stage of the economic development of developing countries. The study has also found that rules and regulations set by governments have not been implemented in a manner that reduces environmental degradation in the region. Worth noting is that the region should collaborate and design its environmental policies in line with the Sustainable Developmental Goals. This is the first step towards environmental sustainability.

Keywords: environmental degradation; institutional quality; natural rents

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1. Introduction

Natural resource rents have contributed meaningfully, specifically in developing economies [1]. Although they have played a huge role in these economies, there are growing concerns about the impact of the extraction processes of natural resources on environmental degradation [2]. By nature, though natural resources are essential, the extraction of these natural resources results in environmental degradation [3]. According to [4], carbon emissions remain one of the major contributors to environmental degradation. The global climate change (2022) further asserts that economic transactions have played a huge role in increasing the carbon dioxide content by 50% over a few years. This shows that the relationship between natural resources and environmental sustainability should not be overlooked.

According to [5], there have been several panel and single-country studies regarding the environmental Kuznets curve. [5] further assert that literature is scarce on the influence of institutional quality in environmental studies, a gap that this paper sought to fill. This gap needs to be explored, especially in developing nations with high pollution levels coupled with weak institutions. According to [6], institution quality is pertinent to achieving

environmental sustainability. The strength of the institutions in managing and regulating extraction processes contributes to preserving the environment and sustainable extraction, which can ultimately reduce environmental degradation [6].

Regarding issues of sustainable development, strong and weak sustainable theories have been considered to anchor an understanding of the environmental sustainability solution while simultaneously ensuring economic growth [7]. Recent studies have shown there has been an increase in air pollution and, simultaneously, an increase in temperatures, with the global temperature increasing by approximately 1% to 6.5% from the preindustrial average [8]. The Global Energy and Carbon Dioxide status report (2020) recently noted a decrease in carbon emissions because of the COVID-19 pandemic during the 2019–2020 period in both developing and developed economies. To sustainably reduce environmental degradation, there is a need to investigate the variables that derive environmental degradation to formulate policies.

The nexus among environment, natural resource rents, and institutional quality in literature has been identified to have a tripartite formulation, according to [9], who explain that the relationship strands from the extraction of natural resources to get natural resource rents affect the environment, while institutional quality is the regulatory component that prevents excessive degradation. The study's novelty pins the analysis on the 1950 Environmental Kuznets Curve (EKC) and the Grossman theory, which link resource dependency, economic growth, and environmental degradation [10]. The EKC theory postulates that the relationship between natural resource rents as a component of economic growth to environmental quality is initially positive, and it becomes negative as the economy reaches the deindustrialization stage [11].

A plethora of studies have analyzed the link between economic growth and natural resource rents, such as [10–12], while there is an empirical gap in the academic works to investigate the relationship between these natural resource rents and institutional quality on environmental degradation. Existing literature analyzing the link between environmental degradation and natural resource rents has identified a direct link between the variables [9]. Ref. [9] found that the link between natural resource rents and environmental degradation is due to three main drivers; energy-intensity production systems, illegal mining, and poor waste management.

Studies of environmental degradation differ in the measurement of the variable from a single variable to composite variables. Single variable measures, such as the level of deforestation, were done by [13], the level of carbon emission by [14], and the carbon footprint was used to measure environmental quality [15]. While other studies, such as those by [4], used index variables such as environmental quality and ecological footprint in their analysis. This study used carbon dioxide per capita since it analyzed the influence of natural resource rents on the environment. Furthermore, the availability of data limited the ability to use other measures of environmental degradation.

The tighter the regulations and the quality of the institutions that implement these regulations, the more sustainable the extraction and reduction of environmental degradation. The institutional quality and environment nexus have been investigated in [9,16,17], and the studies found an inverse relationship between environmental degradation and institutional quality. Ref. [17] further state that the institutional quality is affected by the political will and the administration's goals concerning the economy. Ref. [18] emphasize that economies with a political mandate to grow the economy put little emphasis on implementing policies that reduce environmental degradation since it affects economic growth in resource-dependent economies.

2. Theoretical Literature Review

One of the most pertinent theories explaining the natural resource rents and environmental nexus is the (EKC) developed during the 1950s by Simon Kuznets [17]. The EKC hypothesizes that the link between economic growth and environmental quality follows the inverted U-shaped curve. Specifically, this hypothesis argues that economic growth at

its initial stages degrades the quality of the natural environment. However, at a later stage, when it reaches a certain level, further economic growth improves the quality of the natural environment [19]. In the same vein, empirically, an increase in economic growth (dependent on natural resource rents) leads to a peak of environmental degradation, and then further growth will lead to reduced environmental degradation [20]. However, the work of [2] found economic growth as the main cause of environmental pollution. In line with the theoretical aspect, the environment is damaged as economic activities increase. Refs. [6,17] further point out that international trade and energy use have played a significant role.

Noteworthy is that the study cannot overlook the weak and strong sustainability theories. The weak sustainability can be traced to the neoclassical group, who perceive all natural resources as overabundant or replaceable by another resource [21]. This also implies that environmental degradation can be recompensed by other economic benefits. For instance, carbon emissions that tend to pollute the environment can be recompensed by obtaining emitting licenses, just to mention a few [22]. The weak sustainability proponents posit that emitting licenses protects the environment while at the same time promoting economic activities [23]. In other words, weak sustainability opines that the future generation is responsible for more information generation and advanced technologies that protect the environment. On the other hand, strong sustainability agrees with weak sustainability views and argues that this is the first step to an environmentally friendly environment [21]. However, it is not the only solution to environmental sustainability. Rather, the current generation is responsible for taking care of natural resources useful to the next generation. This emanates from the belief that some natural resources cannot be substituted; thus, they should be preserved now, not later.

Empirical Literature Review

The relationship between natural resource rents and environmental quality has been assessed in several studies, such as [4,18,24]. Ref. [9] states that environmental degradation and natural resource rents can be linked through energy-intensive natural resource extraction methods, leading to high carbon emissions. Therefore, to reduce these carbon emissions, one must reduce mining, which is challenging in resource-dependent economies. Resource-dependent economies can be identified in the literature as countries with a weighting of 10% contribution of natural resources towards their gross domestic product (GDP) and economic growth. Therefore, natural resource-dependent countries require natural resource rents for economic growth, and they take little cognizance of energy usage, especially in developing economies [10,25,26].

When analyzing environmental degradation, institutional quality, and natural resource rents, it is important to consider the role energy consumption plays in the extraction processes. It is produced using coal, which also degrades the environment. Literature exploring the nexus among natural resource rents, energy consumption, and environmental quality used the EKC as a novel theory [3,27]. Ref. [3] found a bidirectional relationship between energy consumption and economic growth since economic growth derives from innovation and the development of environmentally friendly techniques of production, while on the contrary, [8] identified that the relationship between the two variables is unidirectional.

It is important to note that energy consumption emphasizes the degradation of the air component of the environment due to carbon emissions of traditional energy production systems, which are highly dependent on burning coal. Other empirical works that have explored the link between natural resource rents and the environmental quality of other components of the environment have identified that it can be through waste management in mines and land degradation [9]. Primary sector activities such as mining can lead to spillage of oil, disposal of wastes, and land degradation, which affects the environment [9]. While [3] state that illegal mining as an activity and source of natural resource rents can also be identified as a source of high environmental degradation since it is not regulated. These activities can only be curbed through high-quality institutions and political will.

Therefore, the issues of illegal mining, profit-driven companies, and the free good nature of the environment require the regulations of institutions to ensure sustainability. This alone might not guarantee policy implementation, whereas institutions with high-quality regulations can contribute to the reduction of degradation. The importance of institutional quality in terms of curbing environmental degradation has also been studied [9,16]. Ref. [17] states that one cannot separate the institutional quality variable from the stage of development of the economy in question. Ref. [17] further state that low-income countries prioritize economic growth at their initial stage of economic growth forgoing environmental quality. Furthermore, during the industrialization stage, there is a huge extraction of natural resources and dependence on natural resource rents, which weakens the institutional quality and the political will to implement regulatory models that curb environmental degradation [17]. Ref. [11] found that institutional quality has a long cointegration and is negatively associated with environmental degradation, while [17] stated that the extent to which institutional quality enhances environmental quality depends on the presence of rigorous and active institutions that implement policy. Ref. [18] further confirm that strong institutional quality has a negative relationship with environmental degradation and assert that the level of political interference also affects the quality of these institutions.

When analyzing environmental studies, it is important to comprehend the various measures of environmental degradation given the broad definition of an environment as it ranges from land and air to water. Various studies have measured environmental degradation, such as [3,14,16]. Studies such as [18,20] measured the air component of environmental degradation using carbon dioxide emissions in the economy. While [24] further separated the carbon measure using ecological footprints, which are carbon footprint and carbon dioxide pollutants. The broad measures of carbon emissions can be further narrowed down in analysis as it targets separating total emissions by a source. [25] used the emissions from burning fossil fuels and manufacturing cement as a measure of environmental impact in a study of modeling carbon emissions, energy use, and economic growth, while [5] used industrial emissions.

Ref. [14] proxied environmental degradation using economic growth as a measure of environmental degradation in resource-dependent economies. Other studies have used composite variables that measure the environmental quality index and ecological footprint, such as that by [14]. It is a system of measurement that assesses the natural resources used and evaluates the eminence and long-term sustainability [9].

3. Materials and Methods

3.1. Data Sources

The data for the study was sourced from the global economy website. The paper used yearly panel data for sub-Saharan African (SSA) countries from 1994–2020. This period was chosen as it provides a sufficient number of observations.

3.2. Econometric Model

In our empirical estimations of the nexus between natural resource rents, institutional quality, and environmental degradation, carbon dioxide emissions per capita were used as the dependent variable. Carbon dioxide emissions per capita were used in this study as a measure of environmental degradation due to the unavailability of data on the other measures in other countries. Natural resource rents as a percentage of GDP were used as a proxy of natural resource rents, and government effectiveness was used as a measure of institutional quality. Other explanatory variables are trade openness, access to electricity, and energy production for both renewal and non-renewal energy. The study adopted and modified the model by [10], who examined the nexus between CO_2 emissions, resource rent, and renewable and nonrenewable energy in 16 EU countries. The model was formally specified as Equation (1) below.

$$lnCO2_{2i,t} = \alpha + \beta_1 lnGDP_{i,t} + \beta_2 lnRENT_{i,t} + \beta_3 lnREN_{i,t} + \beta_4 lnNREN_{i,t} + \varepsilon_{i,t} \quad (1)$$

where CO_2 is carbon dioxide emissions, GDP represents the real gross domestic product, RENT is total natural rent, REN is renewable energy consumption, and NREN is nonrenewable energy consumption. The model for this study is presented as follows

$$CO2_{2i,t} = f(INR, GPC, TO, FDI, GVE, ACTE, FDIP) \quad (2)$$

For the data series to have a constant variance, the study applied a logarithmic transformation. In log-linear form, Equation (2) was transformed into Equation (3).

$$lnCO2_{2i,t} = \alpha + \beta_1 lnINR_{i,t} + \beta_2 lnGPC_{i,t} + \beta_3 lnTO_{i,t} + \beta_4 lnFDIP_{i,t} + \beta_3 lnACTE_{i,t} + \beta_4 lnGVE_{i,t}\varepsilon_{i,t} \quad (3)$$

where CO_2pc is carbon dioxide emissions per capita, INR is natural resource rents as a % of GDP, GPC is GDP per capita, TO is trade openness, FDIP is foreign direct investment as a % of GDP, GVE is government effectiveness, and ACTE is access to electricity as a % of the population. The measurement of variables and data sources are given in Table 1 below.

Table 1. Description of summary of variables.

Variable	Notation	Measurements	Data Source
Environmental degradation	CO_2pc	Carbon dioxide emissions per capita	The global economy
Natural resource rents	INR	income from natural resources as a % of GDP	The global economy
Institutional quality	GVE	The index of Government Effectiveness	The global economy
Trade openness	TO	Exports plus imports as % of GDP. Calculated as (Exports + imports)/GDP	The global economy
GDP per capita	GPC	GDP per capita is gross domestic product divided by midyear population.	The global economy
Foreign direct investment	FDIP	Foreign direct investment as a % of GDP	The global economy
Access to electricity	ACTE	Access to electricity as a % of the population	

Source: Authors' compilation.

The current paper utilized the dynamic generalized method of moments (GMM) estimation technique to investigate the association between natural resource rents, institutional quality, environmental degradation, and carbon dioxide emissions per capita. The panel consisted of 42 countries between 1994 to 2020. Thus, the GMM is the preferred estimator since the time dimension is smaller than the N dimension [17,28,29]. The GMM estimator corrects endogeneity by introducing more variables to get better results [13,17,29]. The dynamic panel GMM equation can be written in the following specification:

$$lnCO2_{it} = \Phi lnCO2_{it-1} + \beta X_{it} + \gamma V'_{it} + \delta_i + \omega_t + \varepsilon_{it} \quad (4)$$

where $lnCO2_{it}$ is the log of carbon dioxide per capita at country i at time t. $lnCO2_{it-1}$ denotes the carbon emission per capita of the previous year, Φ represents the restriction of the previous carbon emission, X_{it} denotes the regressors variable, which includes the main independent variable of NR as the natural resource as a percentage of GDP, and the country-specific variables, including GPC–GDP per capita, TO—trade openness, FDIP—foreign direct investment as a percentage of GDP, GVE—government effectiveness, and ACTE—access to electricity as a percentage of the population. V'_{it} represents the vector for control variables assumed to be extremely associated with the predictor factor but orthogonal to a margin of error. δ is the delta representing some of the overlooked observations fixed effects, while ω shows the time effects and β *and* γ are parameters. i is the number of cross-sections $(= 1 \ldots, N)$, t is the number of time series $(= 1 \ldots, T)$, and ε_{it} is the error term.

The present study utilized the SGMM system estimator, which uses a greater number of moment conditions [29]. The SGMM controls for heteroscedasticity and serial correlation

by exploiting the weighting matrix. The estimator also transforms the instruments so they may not be correlated and shapes a two equations model, the original and the transformed one [30].

The consistency and robustness of the SGMM were assessed by the Hansen/Sargan test of over-identifying restrictions to confirm the joint validity of the instruments [29–31]. The Sargan/Hansen test expectation is that it should not be significant, implying that the probability values should be more than 10 percent [26,29]. The AR (2) test, on the other hand, tests for the existence of second-order autocorrelation. Thus, if the null hypothesis cannot be rejected, we conclude that moment conditions are correctly specified [29,30,32]. As a result, the AR (2) test should not be significant. In addition, the F-statistics should be significant. The following section presents the empirical results on the nexus between natural resource rents, institutional quality, and environmental degradation.

4. Results

4.1. Descriptive Statistics

Table 2 describes the data for the variables used in the study. Table 2 illustrates that the standard deviations show the sample's variations. A brief look at the data shows that the average environmental degradation in sub-Saharan Africa between 1994 and 2020 was 14,066 metric tonnes per capita of carbon emission. The average for natural resource rents is 11%, above the 10% classification of resource-dependent economies. This shows that most SSA economies are highly dependent on natural resource rents for the growth of their economies, and institutional quality was 0.7229 in the region between 1994 and 2020.

Table 2. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
CO_2pc	1100	0.9578909	1.803217	0.02	11.68
CO_2t	1100	14,066.44	56,548.87	70	447,980
NR	1132	11.32832	11.06935	0	62.04
GPC	1182	2048.416	2743.645	215.75	16,438.64
TO	1085	67.67535	34.11099	0.78	225.02
FDIP	1182	4.2322	9.430602	−11.2	161.82
GVE	967	−0.7229162	0.6116378	−1.88	1.06
ACTE	996	35.73915	26.13975	0.53	100

Source: Authors' compilation from EViews.

Correlation Analysis

The correlation coefficient is illustrated in Table 3. The results illustrate that access to electricity and GDP show a positive and high correlation. This implies that access to electricity increases the GDP per capita in the region. Moreover, other variables show a coefficient of less than 0.8%, signifying the non-existence of a linear relationship among the variables of interest. This further implies that they may be used in the regression.

4.2. Estimation Results

This section discusses the empirical results of the study. The empirical results of the study are based on the two-stepped SGMM in the fifth column of Table 4. Table 4 also presents results for DGMM and the one-stepped SGMM (see first to fourth column) for comparison purposes. The two-stepped SGMM is preferred based on the fact that the SGMM minimizes data loss (by subtracting the average of all the future available observations of a variable) and controls for heteroscedasticity and serial correlation [33].

Table 3. Correlation coefficient matrix.

	lCO$_2$pc	**lCO$_2$t**	**Linr**	**Lgpc**	**Lto**	**Lfdip**	**Lfdib**	**Lgve**	**Lacte**
lCO$_2$pc	1.0000								
lCO$_2$t	0.3860	1.0000							
Linr	−0.3644	0.1318	1.0000						
Lgpc	0.8976	0.3884	−0.4234	1.0000					
Lto	0.4608	−0.0497	−0.1535	0.4653	1.0000				
Lfdip	0.0930	−0.0501	−0.0348	0.0922	0.2825	1.0000			
Lgve	0.5809	0.2218	−0.6505	0.5611	0.3191	0.1475	0.0653	1.0000	
Lacte	0.6462	0.4193	−0.4435	0.7849	0.3267	0.1286	0.2078	0.4154	1.0000

Source: Authors' compilation from EViews.

The fifth column in Table 4 shows that an increase in carbon dioxide emissions per capita in the previous year will increase the carbon dioxide emissions for the current year to 0.15% in SSA countries. This means that the carbon emissions emitted in earlier years have contributed to the current dioxide emissions per capita in SSA countries. With this background, it is vital to contemplate current carbon dioxide emissions levels in future carbon emission alleviation strategies.

Table 4 indicates that the natural resources rents variable has a positive and significant impact on environmental degradation. This result resonates with the empirical works of [5,9,34–37]. Thus, a 1% increase in natural resource rents increased environmental degradation by 0.021% in the SSA countries. This implies that the region has an abundance of coal, forests, minerals, gas, oil, etc., thus causing some serious environmental issues through industrialization processes. Since these countries are pushing for economic advancement, it has led to an increase in the exploitation of these natural resources, which leads to a high quantity of harmful waste produced. The result is in line with the EKC theory stipulating that developing countries tend to experience carbon emissions during their initial phases of economic development. Most SADC countries are still developing. On the other hand, scholars such as [2,6] show an inverse impact of natural resource rents on environmental degradation. The scholars argue that the natural resource rents increase until they reduce carbon emissions, improve economic growth, and lead to economic development.

The results indicate that economic growth positively impacts environmental degradation, which aligns with the empirical literature [18,38]. Thus, a 1% increase in economic growth increases environmental degradation by 0.428. This means that an increase in the number of outputs produced increases the consumption of nonrenewable resources, which tends to pollute the environment. The results are in sync with the EKC, which is the trade-off between economic growth and low environmental quality. As many nations pursue higher economic growth, the environment gets damaged.

Trade openness was found significant and to have a positive impact on environmental degradation in the region. A percent increase in trade openness increases environmental degradation by 0.070. These findings are in sync with the studies done by [6,39]. A region that is open to trade with other countries improves its economic growth, which has a positive relationship with environmental degradation. However, scholars such as [6,40] argue that the direction of the causality differs with countries' income; thus, a low-income region is negatively influenced by trade openness.

The results in Table 4 illustrate that foreign direct investment has a negative impact on environmental degradation, which is consistent with expectations in the literature [19,41]. The existence of foreign direct investment in sub-Saharan Africa to explain environmental degradation is indisputable. Thus, a 1% increase in FDI decreases environmental degradation by 0.007%. This implies investments from developed countries tend to reduce carbon emissions since they use green technology in their production processes. However, Ref. [42]

argue differently. They posit that if foreign investment is from a country that does not use green technology, carbon emission increases at a higher rate.

Table 4. SGMM results: Nexus natural resource rents, institutional quality, and environmental degradation.

	(DGMM_1)	(DGMM_2)	(SGMM_1)	(SGMM_1)	(SGMM_2)
VARIABLES	**lCO$_2$pc**	**lCO$_2$pc**	**lCO$_2$pc**	**lCO$_2$pc**	**lCO$_2$pc**
L.CO2pc	0.126 ***	0.123 ***	0.152 ***	0.154 ***	0.153 ***
	(0.0109)	(0.00148)	(0.0114)	(0.0116)	(0.000929)
Linr	0.0126 *	0.0103 ***	0.0186 ***	0.0263 ***	0.0211 ***
	(0.00725)	(0.00207)	(0.00408)	(0.00422)	(0.00285)
Lgpc	0.235 ***	0.226 ***	0.437 ***	0.429 ***	0.428 ***
	(0.0239)	(0.00645)	(0.0188)	(0.0192)	(0.00956)
Lto	−0.0205 **	−0.0236 ***	0.0445 ***	0.0624 ***	0.0703 ***
	(0.00923)	(0.00463)	(0.00629)	(0.00641)	(0.00915)
Lfdip	0.00563 *	0.00580 ***	−0.00279	−0.00636 **	−0.00675 ***
	(0.00299)	(0.00108)	(0.00282)	(0.00282)	(0.00105)
Lgve	−0.0273	−0.0412 ***	0.104 ***	0.127 ***	0.106 ***
	(0.0177)	(0.0117)	(0.00939)	(0.0102)	(0.00863)
Lacte	0.00102	0.00307	−0.0433 ***	−0.0422 ***	−0.0557 ***
	(0.00994)	(0.00719)	(0.00721)	(0.00731)	(0.0175)
Constant			−2.997 ***	−3.027 ***	−3.011 ***
			(0.118)	(0.118)	(0.0659)
Observations	725	725	767	767	767
Number of countrynum	42	42	42	42	42
Number of instruments	29	29	31	31	31
F-statistics-*p*-value	-	-	[0.000]	[0.000]	[0.000
L. *p*-value	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
AR (1) *p*-value	[0.000]	[0.101]	[0.000]	[0.000]	[0.116]
AR (2) *p*-value	[0.610]	[0.679]	[0.372]	[0.383]	[0.441]
Sargan test *p*-value	[0.001]	[0.001]	[0.000]	[0.000]	[0.000]
Hansen test *p*-value	-	[0.366]	-	-	[0.436]
No. of significant variables	4	5	5	6	6

Note: CO2pc—carbon dioxide emissions per capita; inr—income from natural resource as a % of GDP; gpc—GDP per capita; to—trade openness; fdip— foreign direct investment as a % of GDP; gve—government effectiveness; acte—access to electricity as a % of population; DGMM-1—one-step differenced generalized method of moments; DGMM-2—two-step differenced generalized method of moments; SGMM-1—one-step system generalized method of moments; SGMM-2—two-step system generalized method of moments. Standard errors in parentheses time dummies and robust option used and *p*-values in square brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Source: Author's Compilation from STATA SGMM Regression Results.

The impact of institutional quality on environmental degradation is found to be significant with a positive coefficient. This resonates with the empirical literature, such as [5,11]. Hence, a 1% increase in institutional quality increases environmental degradation by 0.106% in the region. The result is in line with the weak sustainability argument that the future generation should find solutions to environmental degradation. Thus, the current rules and regulations set by the government have not been implemented in a manner that reduces environmental degradation in the region. This implies that government laws are ineffective in controlling environmental degradation. Conversely, Refs. [10,15] illustrate that institutional quality tends to reduce environmental degradation.

Their findings imply that properly implementing the rules builds quality institutions that improve the environmental quality.

The findings indicate an inverse relationship between access to electricity and environmental degradation, in keeping with the available literature [18,24,43]. The results indicate that consistent access to electricity has a significant role in meeting the sustainable development goal of clean energy. Hence, a percent increase in access to electricity reduced carbon emissions by 0.06% in SSA. The result emphasizes access to electricity in the fight against environmental degradation. Some of the implications include the decline in the energy use of coal etc. and an increase in the costs of research & development. In contrast, scholars such as [16,44] posit that almost half of carbon emissions emanate from electricity generation since fossil fuels are the main generators of electricity.

The study used the Hansen test of over-identifying restrictions, that is, to test the validity of the instruments used. Failure to reject H_0 (p-value > 0.05) supports the choice of instruments used in the model. The p-value of the Hansen test was found to be insignificant; thus, the test results reveal that all regressions meet the specification tests, showing that the variables in the study are valid. Furthermore, the number of instruments (31) is less than the number of cross-sections (42). The diagnostic tests reveal an F-statistic significant probability value of 0.000, which is significant and makes the results more robust. The p-value of the lagged dependent variable should be a significant carbon emission lag. AR [2] should be insignificant: test for autocorrelation tests the null hypothesis that the differenced error term is first and the second order is serially correlated. Thus, failure to reject H_0 implies there is no serial correlation and the instruments are correctly specified.

5. Conclusions and Policy Implications

Environmental degradation has become a huge threat worldwide, and the SSA countries are not spared. Within the SSA countries, there is scant literature on how natural resource rents and institutional quality impact environmental degradation. Thus, the hypothesis of this study was to check if natural resource rents and institutional quality do not significantly impact environmental degradation. To achieve this aim, the study applied an advanced and robust two-stepped SGMM technique, which minimizes data loss and automatically controls for heteroscedasticity and serial correlation. The study's findings showed a positive and significant relationship between institutions and environmental degradation. The implication is that, in as much as there are policies in place, these policies are not effective in reducing carbon emissions. One of the major problems in developing countries is not the absence of laws but the implementation thereof. The governments should implement the laws and hold everyone that breaks the environmental laws accountable to reduce environmental degradation. Normally, big companies and multinational companies go unpunished in developing countries because countries are not prepared to lose business. Furthermore, extracting and processing natural resources was found to cause more environmental degradation than electricity use. This is in line with the EKC theory that posits a trade-off between a quest for economic growth with lower environmental quality. The implication is that countries must reinvest the natural resource rents into man-made capital, including clean energy and hydroelectricity, that has the potential to replace the use of nonrenewable resources like coal. The findings suggest that the region is making use of renewable energy from wind, sun, and water to produce electricity. Although the study achieved its objective, a few limitations were identified. For instance, the study did not include some African countries rich in natural resources. For future studies, this can be addressed by adding all the countries in Africa that are rich in natural resources, subject to the availability of data.

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