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RESEARCH ARTICLE

Impact of Political Stability and Globalization on Environmental Quality in Oil-Producing and Non-Oil Producing African Countries

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Abstract

In this study, we use the panel cointegration and causality tests to investigate the impact of political stability (PS) and globalization on environmental quality (EQ) in oil-producing and non-oil-producing African countries from 2002 to 2022. The panel causality test results indicate that, in both oil-producing and non-oil-producing countries, there is short-term causality only between globalization and EQ but long-term causality between PS and globalization and EQ overall. Interestingly, in non-commodity-producing countries, short-run imbalances are eliminated in a much shorter period of time. According to the panel estimators, globalization has a greater impact on EQ than PS in both country groups. Oil-producing countries fail to reap the expected benefits from commodity revenues. In conclusion, since nation-states are insufficient in solving complex socio-economic problems, sharing public sovereignty will help to solve existing problems.

Keywords: *Political stability, Globalization, Environmental quality, African countries*
Jel Codes: *Q01,Q02,Q56*

Siyasi İstikrar ve Küreselleşmenin Petrol Üreten ve Üretmeyen Afrika Ülkelerinde Çevre Kalitesi Üzerindeki Etkisi

Özet

Bu çalışmada, 2002-2022 yılları arasında petrol üreten ve petrol üretmeyen Afrika ülkelerinde politik istikrar ve küreselleşmenin çevresel kalite üzerindeki etkisini araştırılmıştır. Panel nedensellik testinin kullanıldığı çalışma sonuçları, hem petrol üreten hem de petrol üretmeyen ülkelerde kısa vadede yalnızca küreselleşme ile çevresel kalite arasında nedensellik olduğunu, ancak uzun vadede politik istikrar, küreselleşme ve genel olarak çevresel kalite arasında nedensellik bulunduğunu göstermektedir. Buna ek olarak çalışmanın bir diğer sonucu emtia üretmeyen ülkelerde kısa vadeli dengesizliklerin daha kısa sürede ortadan kalktığını göstermektedir. Panel tahmincilerine göre ise küreselleşmenin her iki ülke grubunda da çevresel kalite üzerindeki etkisi politik istikrardan daha büyük olduğu ortaya konmuştur. Bu sonuçlar ışığında çevresel kalite kapsamında düşünüldüğünde, petrol üreten ülkelerin emtia gelirlerinden beklenen faydaları elde edemediği yorumu yapılabilir. Sonuç olarak, çevresel kalitenin arttırılması amacıyla ulus devletler karmaşık sosyo-ekonomik sorunları çözmede yetersiz kaldığı için, kamu egemenliğinin paylaşılması mevcut çevresel sorunların çözülmesine yardımcı olacaktır.

Anahtar kelimeler:*Siyasi istikrar, Küreselleşme, Çevresel Kalite, Afrika Ülkeleri*
Jel Kodu: *Q01,Q02,Q56*

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1. INTRODUCTION

The term "globalization" describes the increasing interdependence of economies on a social, political, and economic level because of international trade, migration, investment, technology, and information sharing. More precisely, it may be described as a shift from traditionally divided economies with barriers, regulations, and distinctions in culture to interconnected, integrated global economies (Hill & Hult, 2019). However, globalization is a complex process that involves rapid social change that occurs concurrently and diagonally in several areas, including the global economy, culture, physical environment, communication, and political changes. Therefore, the process is too complex to hold in its entirety (Tomlinson, 1999). Globalization is so complex because it is an integrated structure with economic, political, cultural, and social components that has the capacity to transform international connections (Tang et al., 2020).

Most countries benefit economically from globalization because it attracts foreign investment, innovative production methods, technology, and improved operational efficiency (Ashraf, 2024). Growing economies are stimulated by globalization, which also unites them. via global cultural linkages, commerce, investment possibilities, and financial movements. Additionally, by focusing on common problems and objectives and cooperating to bridge invention gaps, globalization enables countries to accelerate the innovation process, sharing optimal techniques with one another and enabling the deployment of sustainable energy solutions (Shahbaz et al., 2018).

However, the benefits of globalization in terms of economic growth and human rights also pose potential threats to societies and the environment (Martens & Raza, 2010). In this regard, it is necessary to examine in depth the potential threats that globalization may pose to environmental quality (hereafter EQ) and to develop approaches that address various perspectives and empirical evidence to understand complex relationships (Zhang et al., 2022)

The rapid acceleration of economic expansion has not been without its difficulties, such as the depletion of natural resources, globalization-related problems, and environmental damage (Majeed et al., 2021). Thus, globally there are now significant worries about EQ due to factors including trade liberalization, financial and technology advancements, and Gross Domestic Product (GDP) per capita growth (Sabir & Gorus, 2019).

Globalization has brought about a number of issues, including trade facilitation, financial crises, and increased rates of poverty, as well as environmental degradation that has affected the world economy, particularly in African countries (Yameogo et al., 2021). Even though Africa has abundant renewable energy resources, traditional energy sources are nevertheless used by politicians to achieve better macroeconomic results, which contributes to temperature rise and climate change caused problems (İnal et al., 2022). According to the International Panel on Climate Change (IPCC), the main cause of environmental pollution in the world is human activities, and in order to carry out many of these activities, fossil fuel must be burned (IPCC, 2014). And as a result, oil-producing countries would be regarded as the most polluted in Africa.

Climate change is one of the main problems confronting humanity now. Emissions of greenhouse gases, especially carbon dioxide ($CO2$), have increased because of increased human activity (Bakhsh et al., 2017). In this regard, global warming and pollution have received a lot of attention recently, and the rise in $CO2$ is what led to the increase in global temperature (Paramati et al., 2022).

Evidence of rising global warming and changing climate patterns over the past few decades has been shown. These changes have resulted the decrease in EQ by causing environmental degradation (Muhammad et al., 2017). Thus, most countries are working to safeguard the environment by minimizing $CO2$, as it is believed to be one of the main causes of poor EQ (Kirikkaleli et al., 2023).

Furthermore, it is inadequate to attribute the poor EQ exclusively to economic endeavors. An insufficient knowledge of the sources of CO2 will result from disregarding the influence of governance indicators in this context, such as political stability (hereafter PS) (Bilgili et al., 2024). PS is mostly defined by the capacity of a society to sustain its growth, which is determined by its level. It directs economic activity by forecasting the long run for investors and the conditions under which investments will be made (Kaya & Yalçınkaya, 2017). Societal well-being has traditionally depended heavily on PS.

PS usually comes with stronger governance structures, improved regulatory frameworks, and the ability to implement and enforce environmental protection measures. However, in politically unstable countries, environmental issues can arise as a result of conflicts and corruption, as well as institutional weaknesses (Kirikkaleli & Osmanlı, 2023; Mrabet et al., 2021). Political instability has the potential to harm environmental governance in several ways.

First, internal civil instability and conflicts in the country can impact the ecology and natural resources by causing deforestation, mining, and infrastructural degradation. Second, governments experiencing political instability may be ineffectual in implementing resource-conserving and pro-environmental policies because they prioritize activities that maintain order. Third, corruption and weakness of the rule of law are insufficient to prevent environmentally damaging actions. Finally, political instability and uncertainty might prevent foreign investors from entering the country and investing in ecologically beneficial initiatives (Adebayo & Odugbesan, 2021).

In contrast, politically stable governments may establish systems that promote preservation of the environment. Strong institutions and the rule of law make it simpler to implement environmental protection measures and discourage harmful activities.

The relationship between PS and EQ has received extraordinarily little examination. It has been noted that the majority of research uses pollution and corruption variables to investigate the association between EQ and PS variables. However, to reduce CO2 emissions through climate change legislation should ideally be encouraged by a stable political environment (Su et al., 2021).

While there are numerous studies that examine how PS and globalization affect environmental degradation for specific country cases, the literature does not go far enough in examining this relationship for African countries (Kartal et al., 2023), even though concerns about the long-term depletion of natural resources and their environmental impact are growing in Africa (Karaduman, 2022). For these reasons, it is crucial to assess how PS and globalization affect the EQ of oil and non-oil producing African countries.

As a result, this study, which extensively investigates the influence of PS and globalization on production-based CO2 emissions for oil-producing and non-oil-producing African countries, can fill the gap in the literature by utilizing Dreher's (2006) KOF globalization index.

2. THEORICAL BACKGROUND AND BRIEF LITERATURE

Globalization promotes economic prosperity and growth, particularly in developing countries, by enhancing resource allocation and productivity. Furthermore, globalization, which increases investment opportunities, improves resource allocation for these countries (Beck & Camiller, 2000; Huh & Park, 2019). Although there are many studies investigating the effect of globalization on environmental degradation, no common conclusion has been reached on this subject.

The impact of globalization on the environment is quite diverse and therefore should be analyzed from different theoretical perspectives. Many of the studies examining globalization and its environmental effects have concluded that increasing globalization will also increase CO2 emissions

(Bu et al. 2016; Lv, 2018; Destek, 2020). It is also known as a "pollution haven" in the literature and is related to the increase in environmental deterioration caused by countries as their production increases. This issue, which arose as a result of foreign direct investments that degrade the environment in order to produce more, is common nowadays in less developed or developing countries (Gallagher, 2009). This outcome is due to higher energy dependence in the manufacturing process, which leads to economic expansion. Economic growth improves general productivity, international trade, and FDI. However, it leads to temperature rise and environmental degradation (Shahbaz et al., 2018). In this regard, the rise of global temperatures, increased CO2 emissions, and climate change have raised awareness of EQ and its impacting variables.

Similarly, Grossman and Krueger (1995) contend that globalization provides economies of scale, which increases energy consumption. Additionally, the author says that if increasing energy consumption is not done from clean sources, it will result in an increase in CO2 emissions. Increasing CO2 emissions will also cause more environmental damage. Bu et al. (2016) conducted one of the most extensive research on the influence of globalization on EQ. Globalization has been shown to have a significant influence of debasement on EQ in the 166 countries studied. Similarly, Yang et al. (2021) determined from an analysis of Gulf Cooperation Council (GCC) countries that globalization decreases EQ. Haseeb et al. (2018) found that globalization improved EQ in Brazil, China, and South Africa but had a negative impact in India and Russia. Lastly, Destek (2020) who studied Central and Western European countries, determined that globalization had a detrimental impact on EQ.

In contrast to earlier studies, several researchers have discovered that globalization improves EQ. The reasons why globalization has a beneficial environmental impact are because it delivers environmentally friendly innovations that improve real GDP development while causing little damage to the environment (Jahanger et all., 2022; Ozcan et al., 2020; Tamazian & Bhaskara Rao, 2010; Usman et al., 2021). Additionally, globalization's positive environmental impact requires that the country's industrial structure adopt eco-friendly (Zaidi et al., 2019). By doing so, Shahbaz et al. (2015) have also shown that globalization has helped countries that are developing cut CO2 emissions and enhance their EQ. Lastly, Saud et al. (2020) have concluded that globalization has made a favorable impact on improving EQ. The fundamental reason why globalization improves EQ in the analyzed countries is explained by its crucial role in economic growth by attracting FDI, eco-friendly manufacturing methods, and efficiency in operational processes.

Stable governments are more successful in establishing a stronger management system. Thus, PS makes it easier to adopt and execute environmental protection measures. Similarly, stable governments prioritize long-term sustainable development goals over short-term economic gains by implementing policies such as resource conservation and pollution control (Kartal et al., 2024; Kılıç Depren et al., 2023; Sui et al., 2021).

Politically stable governments also tend to be stable in terms of macroeconomics and exchange rates. Stable macroeconomic indicators and exchange rates are factors that encourage investment and development (Pettinger, 2022). PS is also seen to be highly appealing in terms of attracting international capital investments, and it has the potential to affect all sectors of the economy, particularly the banking industry (Venâncio de Vasconcelos, 2020).

Although there are many studies investigating the impact of PS on EQ, studies examining the impact of PS on the environment are scarce. Gani's (2012) study is the best-known of them. The author contends that PS has a detrimental impact on CO2 emissions. The author, who investigated the relationship between good governance and CO2 in developing countries, incorporated PS as a factor of good governance into the model. And the author concluded that PS and CO2 emissions are negatively correlated. Similarly, Purcel (2019) examined the effect of PS on EQ for low-and middle-income countries. The study indicated that PS had a detrimental impact on CO2 emissions, but only after the optimal level was attained. Abid (2016) conducted another study on the relationship between PS and environmental effect. The study, which looked at the impacts of democracy, corruption, government performance, politics, and socioeconomic instability on CO2 emissions in Sub-Saharan Africa, found that instability in these variables had a positive connection with emissions. Lastly, arguing that strong institutions will reduce political instability, Ashraf et al. (2022) found a negative correlation between PS and CO2 emissions.

3. DATA AND METHODOLOGY

3.1 Data and Model

This study examines the impact of PS and globalization on EQ (CO_2 emissions) among African countries in the period 2002-2022. We use PS indices following Kartal et al. (2023) and globalization indices following Liu et al. (2020) and Koengkan et al. (2020).

Table 1. Variable's Definition

Data	Symbol	Measurement	Source	Hypotheses
Environmental Quality (lnCO_2 emissions)	EQ	Mt CO2e	WB	-
Political Stability (lnPS)	PS	Index value $-2.5 \leq PS \leq +2.5$	WB	PS positively affects EQ
KOF Index of Globalization	lnGI	Index value) $0 \leq KOF \leq 100$	KOF	lnGI positive or negative affects EQ

Note: KoF and WB shows Konjunkturforschungsstelle of ETH Zurich and World Bank database, respectively.

3.2 Methodology

The present study utilized the growth model that follows, drawing from prior research in relevant literature:

$$EQit = \beta0 + \beta1PSit + \beta2lnGIit + \varepsilon it \quad (1)$$

where i = 1, 2,…,11 refers to each country in the panel while t = 2002, 2003, …,2022 is the time period. β_0 is the constant term; β_1 and β_2 are the slope parameters of the explanatory variables, and ε_{it} is the error term. For cross-sectional dependence (hereafter CSD), CD and LM tests are applied. The CSD hypothesis is tested using the procedures proposed by Breusch & Pagan (1980), Pesaran (2004), Pesaran et al. (2008). The Lagrange Multiplier (hereafter LM) test statistic is defined as,

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \quad (2)$$

$$LM_{adj} = \sqrt{\frac{2}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} T\, \hat{\rho}_{ij}^2 \frac{(T-k)\hat{\rho}_{ij}^2 - \mu_{Tij}}{\sqrt{\vartheta_{Tij}^2}}} \quad (3)$$

(Breusch & Pagan, 1980; Pesaran et al., 2008). For CD tests, the test statistics are given as;

$$CD_{LM} = \sqrt{\frac{1}{N(N-1)} \sum_{i)1}^{N-1} \sum_{j=i+1}^{N} \left(T\hat{\rho}_{ij}^2 - 1\right)} \quad (4)$$

and

$$CD = \sqrt{\frac{2T}{N(N-1)} \sum_{i)1}^{N-1} \sum_{j=i+1}^{N} T\hat{\rho}_{ij}^2} \quad (5)$$

(Pesaran, 2004). In CSD tests, the null hypothesis states that there is no cross-sectional dependence among the countries in the panel, against the alternative hypothesis that CSD exists. To detect economic internal/external shocks, panel unit root (hereafter PUR) tests are employed. The bootstrap PUR test developed by Smith et al. (2004) obtains critical values through bootstrapping, offering an advantage over other PUR tests. The test statistic is;

$$\overline{LM} = N^{-1} \sum_{i=1}^{N} LM_i \quad (6)$$

and LM is the arithmetic mean of the test statistics. where the arithmetic mean of LM test statistics is used. (Pesaran, 2007) extends the Augmented Dickey-Fuller (ADF) regressions by including cross-sectional averages of the lagged levels and first differences of the variables. The Cross-Sectionally Augmented Dickey-Fuller (hereafter CADF) regression model is specified as:

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + d_0 \bar{y}_{t-1} + \sum_{j=0}^{p} d_{j+1} \Delta y_{t-j} + \sum_{k=1}^{p} c_k \Delta y_{i,t-k} + \varepsilon_{it} \quad (7)$$

The CIPS test statistic is computed as the arithmetic mean of the CADF statistics calculated for each i:

$$\mathrm{CIPS}(N,T) = N^{-1} \sum_{i=1}^{N} t_i(N,T) \quad (8)$$

The CSD tests proposed by Breusch & Pagan (1980), Pesaran (2004) and Pesaran et al. (2008) also consider whether the slope coefficients of each country in the panel are equal. In these tests, the null hypothesis assumes homogeneity (equal slope coefficients), while the alternative hypothesis tests for heterogeneity (different slope coefficients). In the error correction model proposed by Westerlund (2008);

$$\alpha_i(L)\Delta y_{it} = \delta_{1i} + \delta_{2i}t + \alpha_i\left(y_{it-1} - \hat{\beta}_l x_{it-1}\right) + \gamma_i\left(\dot{L}\right)\vartheta_{it} + \varepsilon_{it} \tag{9}$$

If $\alpha_i = 0$, there is no cointegration in the model. The cointegration test is conducted to analyze whether the variables in model (1) move together in the LR. In the panel vector auto regression model (PVAR), the auto regression parameters that emerge by selecting the optimal lag length are subjected to F-test to determine the SR causality relationship. Panel error correction model (PVECM);

$$\Delta EQ = \delta_{1i} + \sum_{p=1}^{k} \delta_{11ip}\Delta EQ_{it-p} + \sum_{p=1}^{k} \delta_{12ip}\Delta PS_{it-p} + \sum_{p=1}^{k} \delta_{13ip}\Delta \ln GI_{it-p} + \phi_1\hat{\varepsilon}_{it-1} + \varepsilon_{it} \tag{10}$$

In this model, the null hypotheses for short-run causality are $\sum_{p=1}^{k}\delta_{12ip}\Delta PS_{it-p} = 0$ no causality from PS to EQ, $\sum_{p=1}^{k}\delta_{13ip}\Delta lnGI_{it-p} = 0$ no causality from lnGI to EQ. If the alternative hypothesis is accepted, causality exists. In the long-run causality test, the null hypothesis is $\phi_1\hat{\varepsilon}_{it-1} = 0$, which tests for the absence of causality from PS and lnGI to EQ as a whole. The Panel Augmented Mean Group (AMG) estimator method provides more robust results for panels exhibiting both CSD and heterogeneity. AMG estimation is performed in two stages. In the first stage;

$$\delta Y_{it} = \varphi_i + \delta_i \delta X_{it} + \theta_i f_t + \sum_{t=2}^{T} \pi_i \delta D_t \tag{11}$$

and in the second stage;

$$\hat{\delta}_{AMG} = N^{-1}\sum_{i=1}^{N} \hat{\delta}_i \tag{12}$$

Here, $\varphi_i$is the constant term, Y_{it} and X_{it} represent the dependent and independent variables, f_t denotes heterogeneous components, and $\hat{\delta}_{AMG}$ represents the AMG estimators (Westerlund & Edgerton, 2008); Eberhardt & Bond, 2009).

4. RESULTS

Table 2. CSD Tests

	Oil Producing Countries			Non-Oil Producing Countries		
	EQ	**PS**	**lnGI**	**EQ**	**PS**	**lnGI**
CD_{lm} (BP,1980)	132.587 (0.00)[a]	145.723 (0.00)[a]	129.543 (0.00)[a]	458.0 (0.00)[a]	598.743 (0.00)[a]	431.77 (0.00)[a]
CD_{lm} (Pesaran, 2004)	3.083 (0.00)[a]	4.056 (0.00)[a]	2.857 (0.00)[a]	4.038 (0.00)[a]	9.35 (0.00)[a]	3.048 (0.00)[a]
CD (Pesaran, 2004)	0.852 (0.197)	-2.419 (0.00)[a]	-1.178 (0.11)	-2.829 (0.00)[a]	-2.417 (0.00)[a]	-2.717 (0.00)[a]
LM_{adj} (PUY, 2008)	-2.356 (0.00)[a]	1.049 (0.14)	-3.341 (0.99)	3.080 (0.00)[a]	6.832 (0.00)[a]	-0.224 (0.58)

p<0.01 a

According to the results indicated in Table 2 both oil producing and non-oil producing countries have cross-sectional dependence in the variables used in the model.

Table 3. Panel Unit Root Test

	Constant		**Constant and Trend**		**Constant**		**Constant and Trend**	
	Statistic	**p-value**	**Statistic**	**p-value**	**Statistic**	**p-value**	**Statistic**	**p-value**
	Oil Producing Countries				**Non-Oil Producing Countries**			
Panel A. Smith et. al. (2006)								
Levels								
EQ	-1.431	0.43	-2.07	0.46	-4.686	0.00[a]	-4.563	0.00[a]
PS	-1.835	0.15	-2.157	0.43	-4.443	0.00[a]	-4.573	0.00[a]
lnGI	-1.879	0.10	-1.78	0.88	-3.566	0.00[a]	-4.115	0.00[a]
First difference								
EQ	-3.977	0.00[a]	-4.147	0.00[a]	-5.189	0.00[a]	-5.021	0.00[a]
PS	-4.373	0.00[a]	-4.465	0.00[a]	-5.479	0.00[a]	-5.393	0.00[a]
lnGI	-3.707	0.00[a]	-4.211	0.00[a]	-6.545	0.00[a]	-6.434	0.00[a]
Panel B. CIPS (Pesaran, 2007)								
Levels								
EQ	-1.766		-3.287[a]		-1.775		-3.444[a]	
PS	-1.733		-1.432		-2.451[b]		-2.378	
lnGI	-1.469		-2.705		-1.806		-2.408	
First difference								
EQ	-2.234[c]		-2.428[b]		-3.481[a]		-1.850	
PS	-2.075		-2.973[c]		-3.131[a]		-2.592	
lnGI	-2.569[b]		-1.790		-3.160[a]		-2.710	

Notes: Probability values are bootstap values in the Smith et. al. (2004) test. Critical values of the panel statistic are -2.57 (1%), -2.33 (5%) and -2.21 (10%) for the model with constant (Pesaran 2007, table II(b), p:280); -3.10 (1%), -2.86 (5%) and -2.73 (10%) for the model with constant and trend (Pesaran 2007, table II(c), p:281). Panel CIPS statistics are the average of CADF statistics. The maximum lag length is taken as 4 and the optimal lag lengths are determined by the general-to-specific approach. Probability values are obtained from 5000 bootstrap distribution. p<0.01 a

Table 3 shows the (Smith et al., 2004) and (Pesaran, 2007) panel unit root test results are presented. (Smith et al., 2004) panel unit root test, all variables in oil producing countries have unit root at level value and become stationary when first differences are taken. On the other hand, oil non-producing countries have a very different unit situation. All countries in the model variables are stationary at level values. However, in the (Pesaran, 2007) test the results are more different. EQ varies in both oil producing and non-oil producing economies in the level-trend model, and PS in non-oil producing economies. is stationary in the model with constant. When the first differences of all three variables are taken, unit root problem persists in the trend model in non-oil producing economies for oil producing economies. For oil producing economies, PS in the fixed model and lnGI in the trended model unit root problem persists in the variable.

Table 4. CSD, Homogeneity and Cointegration Tests

	Oil Producing Countries			**Non-Oil Producing Countries**		
	Statistic	**Asymptotic p-value**	**Bootstrap p-value**	**Statistic**	**Asymptotic p-value**	**Bootstrap p-value**
CSD tests:						
CD_{lm} (BP,1980)	167.927	0.00[a]		1250.513	0.00[a]	
CD_{lm} (Pesaran, 2004)	5.702	0.00[a]		33.950	0.00[a]	
CD (Pesaran, 2004)	4.811	0.00[a]		24.301	0.00[a]	
LM_{adj} (PUY, 2008)	11.804	0.00[a]		36.474	0.00[a]	
Homogeneity tests:						
$\tilde{\Delta}$	11.878	0.00[a]		19.641	0.00[a]	
$\tilde{\Delta}_{adj}$	13.280	0.00[a]		21.960	0.00[a]	
Panel Cointegration						
Constant	0.874	0.97	0.19	3.231	0.79	0.00[a]
Constant and Trend	3.433	0.97	0.00[a]	3.231	0.80	0.00[a]

Notes: Model (1) is estimated. Asymptotic probability values are obtained from the standard normal distribution. Bootstrap probability values are obtained with 5000 iterations. p<0.01 a.

A combined display of the CSD, Homogeneity, and Cointegration Tests results are shown in Table 4. In model (1), there is CSD and the slope parameters of each country in the panel have a heterogeneous structure. In the LM bootstrap (LM_N^+) test, cointegration is found in the constant and constant+trend models according to the asymptotic p value. However, according to bootstrap probability values, there is no long-run relationship at 1% significance level. The relationship breaks down with the addition of the trend variable. Countries with oil income are affected by the volatility in commodity prices. Non-oil producing countries are affected by the negative economic shocks caused by global economic crises. With the effect of the trend, it is thought that the globalization index, one of the independent variables in model (1), interacts on EQ in the long run.

Table 5. Panel VAR and Panel VECM Causality Tests

Short Run (PVAR)			Long Run (PVECM)		
Hypothesis	**Oil Producing Countries**	**Non-Oil Producing Countries**	**Hypothesis**	**Oil Producing Countries**	**Non-Oil Producing Countries**
$\Delta(PS) \neq> \Delta(EQ)$	0.785 (0.67)	1.879 (0.59)	$\Delta(PS)\ and \Delta(lnGB) \neq> \Delta(EQ)$	-0.29 [-5.515][a]	-0.339 [-8.645][a]
$\Delta(EQ) \neq> \Delta(PS)$	0.958 (0.61)	3.515 (0.31)	$\Delta(EQ)\ and \Delta(lnGB) \neq> \Delta(PS)$	0.32 [0.965]	-0.047 [-0.226]
$\Delta(lnGB) \neq> \Delta(EQ)$	15.951 (0.00)[a]	11.762 (0.02)[b]	$\Delta(PS)\ and \Delta(EQ) \neq> \Delta(PS)$	-0.053 [2.649][a]	-0.019 [1.890][c]
$\Delta(EQ) \neq> \Delta(lnGB)$	0.629 (0.72)	2.299 (0.51)			
$\Delta(PS) \neq> \Delta(lnGB)$	2.190 (0.33)	2.851 (0.41)			
$\Delta(GB) \neq> \Delta(lnPS)$	2.573 (0.27)	5.046 (0.16)			

Notes: a p<0.01, b p<0.05, c p<0.1 () and [] show probability value and t statistics, respectively. ≠>This notation is the null hypothesis of no causality.

Table 5 shows the results of Panel VAR and Panel VECM Causality Tests. In oil producing countries, there is causality only from lnGB to EQ in the short run. In the long run, there is causality from PS and lnGB to EQ as a whole. Moreover, the imbalances arising in the model are rebalanced in approximately 3.44 years.[1] A similar situation emerges in non-oil producing countries. The same results are valid for short and long run causality. Moreover, short-run imbalances tend to stabilize in a shorter time (2.94 years) in non-oil producing countries. There is no causality between PS and lnGB in the short run in both oil and non-oil producing countries. With globalization, political structures enter into more intricate relationships. Stakeholders common to the nation-state emerge in decision-making mechanisms, non-governmental organizations, multinational corporations, military alliances, and structures limit state authority and make them partners in solving global problems. This situation results in the sovereignty of nation states being shared. However, since nation states are inadequate in solving complex political and economic problems today, sharing state sovereignty will allow problems to be solved more efficiently. The reason PS in oil-producing countries is not effective on EQ should be evaluated through energy geopolitics. Energy geopolitics includes not only the countries with energy resources, but also all components of global geopolitics as it encompasses all geographical elements involving the energy supply-demand relationship. Oil resources, which have been asymmetrically distributed after the Second World War (especially in Russia, the Middle East, and the MENA region), have opportunities that cannot be ignored by developing countries seeking to gain a place in the global energy paradigm. Oil-producing countries will always be in a prominent position for emerging economies that want to have a primary source of energy in the process of economic growth.

[1] The error correction coefficient is calculated as $1/\phi_1$ based on regression number 10. Accordingly, $\frac{1}{0.339} \cong 2.94$ ve $\frac{1}{0.29} \cong 3.44$ have been obtained.

Table 6. Augmented Mean Group (AMG) Estimator Test

Oil Producing Countries				Non-Oil Producing Countries			
	Constant	**PS**	**lnGB**		**Constant**	**PS**	**lnGB**
Algeria	5.548 (0.00)[a]	0.214 (0.11)	-0.350 (0.06)[c]	Benin	-0.271 (0.85)	-0.057 (0.46)	2.312 (0.00)[a]
Angola	-3455 (0.17)	-0.11 (0.09)[c]	4.701 (0.00)[a]	Burkina Faso	2.216 (0.05)[c]	0.089 (0.02)[b]	0.499 (0.48)
Cameroon	3.734 (0.01)[b]	-0.078 (0.00)[a]	-0.041 (0.96)	Burundi	2.964 (0.05)[c]	0.0007 (0.98)	-0.523 (0.37)
Chad	2.142 (0.00)[a]	-0.019 (0.53)	0.462 (0.04)[b]	Cabo Verde	0.227 (0.21)	0.021 (0.64)	1.465 (0.02)[b]
Congo, Rep.	3.768 (0.00)[a]	0.130 (0.00)[a]	-0.050 (0.92)	Cent. Afr. Rep.	4.003 (0.00)[a]	0.175 (0.04)[b]	-0.943 (0.18)
Cote d'Ivoire	1.984 (0.57)	0.041 (0.60)	1.091 (0.61)	Comoros	6.213 (0.00)[a]	0.005 (0.88)	-2.827 (0.00)[a]
Egypt	2.080 (0.00)[a]	-0.036 (0.07)[c]	1.705 (0.00)[a]	Eritrea	4.904 (0.02)[b]	0.128 (0.11)	-1.418 (0.34)
Gabon	5.450 (0.00)[a]	0.017 (0.77)	-1.008 (0.06)[c]	Ethiopia	4.047 (0.00)[a]	0.014 (0.80)	-0.237 (0.63)
Ghana	2.177 (0.19)	0.026 (0.78)	0.921 (0.34)	Gambia	1.751 (0.26)	-0.059 (0.19)	0.465 (0.62)
Libya	4.762 (0.00)[a]	0.033 (0.16)	-0.060 (0.93)	Guinea	3.078 (0.06)[c]	-0.032 (0.19)	0.050 (0.96)
Morocco	1.258 (0.15)	0.006 (0.87)	1.887 (0.00)[a]	Guinea-Bissau	1.646 (0.00)[a]	0.078 (0.02)[b]	0.446 (0.01)[b]
Nigeria	8.634 (0.00)[a]	0.050 (0.43)	-2.120 (0.00)[a]	Kenya	-0.580 (0.67)	-0.004 (0.96)	2.636 (0.00)[a]
Sudan	1.467 (0.16)	-0.098 (0.00)[a]	1.443 (0.02)[b]	Lesotho	1.611 (0.11)	0.067 (0.07)[c]	1.009 (0.105)
Tunisia	2.792 (0.00)[a]	-0.005 (0.60)	0.869 (0.00)[a]	Madagascar	0.924 (0.18)	0.075 (0.02)[b]	1.394 (0.00)[a]
				Malawi	4.650 (0.00)[a]	-0.195 (0.00)[a]	-1.082 (0.11)
				Mali	-3.396 (0.02)[b]	0.033 (0.07)[c]	3.978 (0.00)[a]
				Mauritania	2.391 (0.00)[a]	-0.005 (0.80)	0.449 (0.22)
				Mozambique	1.055 (0.23)	-0.083 (0.00)[a]	1.340 (0.01)[b]
				Niger	0.462 (0.80)	-0.088 (0.29)	1.549 (0.21)
				Rwanda	3.740 (0.00)[a]	-0.077 (0.03)[b]	-0.679 (0.01)[b]
				Senegal	1.105 (0.14)	0.014 (0.78)	1.504 (0.00)[a]

				Sierra Leone	1.244 (0.19)	-0.147 (0.18)	0.873 (0.13)
				Tanzania	0.208 (0.86)	-0.027 (0.55)	2.063 (0.00)[a]
				Togo	1.618 (0.20)	0.006 (0.90)	0.982 (0.21)
				Uganda	1.126 (0.32)	0.180 (0.04)[b]	1.435 (0.02)[b]
				Zambia	4.286 (0.10)	-0.080 (0.02)[b]	-0.595 (0.69)
				Zimbabwe	5.112 (0.03)[b]	0.163 (0.04)[b]	-0.547 (0.70)
Panel	3.024 (0.00)[a]	-0.001 (0.92)	0.674 (0.11)	Panel	2.086 (0.00)[a]	0.007 (0.40)	0.577 (0.03)[b]

Notes: a $p<0.01$, b $p<0.05$, c $p<0.1$

Augmented Mean Group (AMG) Estimator Test findings are displayed in Table 6. Among the oil producing countries, the parameters of the PS variable are statistically significant in Angola, Cameroon, Congo, Rep., Egypt, and Sudan. In this group of countries, the lnGB variable is statistically significant in Algeria, Angola, Chad, Egypt, Gabon, Morocco, Nigeria, Sudan, and Tunisia. In non-oil producing countries, the parameters of the PS variable are statistically significant in Burkina Faso, Cent. Afr. Rep., Guinea-Bissau, Lesotho, Madagascar, Malawi, Mali, Mozambique, Rwanda, Uganda, Zambia, and Zimbabwe. Among non-oil producing countries, lnGB is statistically significant in Benin, Cabo Verde, Comoros, Guinea-Bissau, Kenya, Madagascar, Mali, Mozambique, Rwanda, Senegal, Tanzania, and Uganda. Globalization has a multiplier effect on EQ in non-oil producing countries.

5. DISCUSSION

The negative coefficients in Angola, Cameroon, Egypt, and Sudan (oil producing) and Malawi, Mozambique, Rwanda, and Zambia (non-oil producing) suggest that PS has a positive impact on EQ. In line with Danish et al. (2019) and Andlib and Salcedo-Castro (2021), stability in government policies in these countries helps the market mechanism to work effectively and supports EQ. According to Shahbaz et al. (2018), globalization affects energy consumption and indirectly EQ through three channels, namely (i) the scale effect, (ii) the technique effect, and (iii) the composition effect. Accordingly, in Angola, Chad, Egypt, Morocco, Sudan, and Tunisia (oil producing) and Benin, Cabo Verde, Guinea-Bissau, Kenya, Madagascar, Mali, Mozambique, Senegal, Tanzania, and Uganda (non-oil producing), the scale effect is valid. Accordingly, ceteris paribus, acceleration of economic activity leads to environmental degradation. This is because with the globalization process, dirty industries are transferred to developing countries and reduce EQ. According to the pollution refuge hypothesis, less developed countries implement flexible environmental policies to access FDI. In Algeria, Gabon, and Nigeria, "the technique effect" is valid. Energy consumption decreases because of these countries importing advanced technology that realizes their economic activities. According to Yuping et al. (2021), Saud et al. (2020), and Jahanger et al. (2022), globalization can make significant contributions to the economic development process by bringing technological efficiencies in the production process through foreign investment and innovative production techniques. In Comoros and Rwanda, the "composition effect" is valid. In these countries, economic activity is experiencing a sectoral transition from agriculture to manufacturing and from manufacturing to services. With the composition effect, EQ improves as energy consumption in the manufacturing industry shifts to the services sector.

Our panel causality results reveal a complex relationship between globalization, PS, and EQ. These results both confirm and differ from the existing literature. The finding of short-run causality between globalization and EQ in both oil-producing and non-oil-producing countries is consistent with the view that globalization exerts pressure on other variables. This reflects concerns that, particularly in countries with weaker environmental regulations, greater economic activity brought on by globalization may result in more pollution and resource degradation (Kiogora, 2016).

However, the causality from PS to globalization to EQ reveals a critical nuance. This supports the idea that governments with stable political structures are better equipped to control their environments and have greater capacity to implement environmental protection measures (Andlib et al., 2024) Sustainable initiatives may be avoided and environmental management hindered in countries with unstable political systems (Leitão, 2016).

Our results, which show that globalization has a greater effect on EQ than PS, seem contradictory when compared to the literature. However, when the nature of these impacts is considered, they are similar to the literature in many respects. The environmental impacts of globalization are often direct and easily observable (e.g., increased emissions from industrial production). However, the impact of PS is indirect, and this indirect impact also shapes globalization (Esty & Porter, 2005).

Short-term imbalances that occur in non-commodity producing countries can be eliminated more quickly. The reason why shocks are overcome in the short term and their effects last less than in commodity producing countries is consistent with the idea that diversified countries are resilient to environmental shocks. The fact that dependence on natural resource extraction in these countries leads to environmental degradation and political instability also produces results that support the "resource curse" hypothesis for many commodity producing countries (Atkinson & Hamilton, 2003).

However, PS offers the essential basis to long-term environmental conservation and efficient environmental management (Andlib et al., 2024).

6. CONCLUSION and POLICY IMPLICATIONS

Sustainability of EQ is becoming one of the most important policy objectives for both developed and developing countries. Commercial globalization is an important component of EQ, and political globalization is an important component of PS. The objective of PS is to increase the efficiency of production factors and improve EQ by helping the institutional structure to support economic growth. Through panel causality and parameter estimation, we revealed important economic findings. Congo, Burkina Faso, Cent. Afr. Rep., Guinea-Bissau, Lesotho, Madagascar, Mali, Uganda, and Zimbabwe should take steps to ensure PS since it improves institutional quality. This will ensure that the public authority pays due attention to EQ, which will lead to more foreign direct investment. There is evidence that trade globalization increases EQ. In Angola, Chad, Egypt, Morocco, Sudan, Tunisia, Benin, Cabo Verde, Guinea-Bissau, Kenya, Madagascar, Mali, Mozambique, Senegal, Tanzania, and Uganda, globalization should encourage foreign capital investments that will bring innovative production methods, advanced industrial technology, modern knowledge, and skills. However, in this process, the introduction and enforcement of strict environmental rules for firms should not be neglected.

At the outset of this research, we assumed that countries with commodity income would have high EQ, assuming that social welfare would be shared equally and democratic participation would be higher during the economic growth process. Our empirical research, however, showed that in both oil-producing and non-oil-producing countries, PS and globalization have comparable effects on EQ.

As expected in economic theory due to their low savings rates, non-oil producing countries aim for "sustainability of economic growth." However, political instability in the Middle East is driving oil-importing developing countries to the Caspian Basin and the high energy demanding Chinese economy to Russia. This period of distraction in global energy geopolitics may present an opportunity for oil-producing countries to improve EQ through political stabilization and institutional strengthening.

DECLARATIONS

FUNDING / SUPPORT INFORMATION

No funding was received for this study.

CONTRIBUTIONS OF AUTHORS

The authors contributed equally.

CONFLICT OF INTEREST

There is no potential conflict of interest in this study

DATA AVAILABILITY

The data can be provided upon request by the author(s).

ETHICAL STATEMENT

The study was conducted using secondary data and did not require ethical approval.

ARTIFICIAL INTELLIGENCE (AI) USAGE STATEMENT

No AI-based tools were used in this study.

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