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Geopolitical Risk, Globalization and Environmental Degradation in South Africa: Evidence from Advanced Quantiles Approach

Ryzyko geopolityczne, globalizacja i degradacja środowiska w Afryce Południowej: dowody z zaawansowanego podejścia kwantylowego

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Abstract

Sustainable development involves the incorporation of socio-economic concerns and environmental protection into the economic decision-making process, in such a way that, any developmental effort would eventually be favorable to immediate and future generations. It is against this backdrop this study investigates the effects of geopolitical risk and globalization on environmental degradation in South Africa over the period 1985Q1-2018Q4. This study improves on existing studies and raises concerns on the potential twin-effect of geopolitical risk and globalization on the environment. We deviate from the existing studies that make use of the mean causality approaches that do not consider possible dependence in the conditional tail of the series distribution. To examine whether the causality exists among the series, we make use of the novel Troster (2018) Granger non-causality in condition quantiles, which captures the pattern of causality in various quantiles. Empirical results show that there is feedback causality nexus between geopolitical risk and CO_2 emissions. In majority of the quantiles, feedback causality is also observed between globalization and CO_2 emissions. We find a bidirectional Granger causality nexus between geopolitical risk and environmental degradation, and between globalization and environmental degradation. Globalization and geopolitical risk negatively influence environmental degradation. We conclude that environmental degradation is not driven by globalization and geopolitical risk in South Africa, among other policy suggestions.

Key words: geopolitical risk, globalization, environmental degradation, advanced quantiles approach, South Africa

Słowa kluczowe: ryzyko geopolityczne, globalizacja, degradacja środowiska, zaawansowane podejście kwantylowe, Afryka Południowa

1. Introduction

South Africa's classification of sustainable development (*hence SD*) is subjective to the generally acknowledged designation delivered by the Brundtland Commission. This definition is rooted in the nation Constitution. This Constitution (Section 24 (b), (ii)) ensures that the citizenry have the right to be *environmentally protected, for the benefit of present and future generations, through reasonable legislative and other measures that secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*. The nation has passed its sustainable developmental efforts and programs in the law. Thus, SD according to the National Environmental Management Act (1998) is *the integration of social, economic, and environmental factors into planning, implementation, and decision-making so as to ensure that development serves present and future generations.* This study lay emphasis on the environmental sustainability aspect of sustainable development since environmental sustainability is a necessary and sufficient condition for an all-inclusive sustainable development.

In order to deviate from the existing studies on drivers of environmental degradation, this study investigates the effects of geopolitical risk and globalization on environmental degradation in South Africa. There are two (2) major reasons for selecting South Africa as a case study to examine the interaction and interconnectedness among these series. First is the issue of globalization, which in this present-day economy, can never be overemphasized in making economic and environmental decisions; most specifically, with the grievous impacts of the COVID-19 pandemic on all spheres of life. Integration of the world economies continues to hasten in various areas such as economic, social, and political fields, international investments and trade activities beginning to grow in various parts of the world (Rafindadi & Usman, 2019). On one hand, Rafindadi and Ozturk (2017) argue that in Africa, South Africa has the most productive mechanized economic system. On the other hand, the economy was once sheltered from the grievous effect of globalization by the isolation and sanctions of the apartheid in the 90s. The isolation and sanctions of the apartheid period did not only affect the economy but also all aspects of life (socio-cultural) in the country. Thus, this development makes it imperative to investigate whether the pressure the world economies are facing, most especially South Africa, is as a result of globalization. Empirically, the nexus between globalization and environmental degradation is limited for Africa (Rafindadi, 2016), let alone South Africa (Salahuddin et al., 2019). Thus, it becomes expedient to examine the interrelation among these series, as policy implications from this study will be useful for the government, policymakers and interested individuals in the country and across Africa for effective economic and environmental decision-making.

Second is the issue of geopolitical risk. Over the years, the incidence of geopolitical risk and conflicts has been on the increase in virtually every part of the world. Nations have experienced increased terrorism, wars, political tensions, and conflicts, to say the least. Geopolitical risk has economic, social and political impacts, which have been reported to impact on environmental degradation[1]. For example, the multiplier impacts of some specific geopolitical events, such as the September 11 (9/11) Trade Tower attack in the US, Bombay attack and China-US trade wars, among others have impacted on investors and affected business decisions across the globe. Institutions such as the International Monetary Fund (IMF), World Bank and Central Bank now consider geopolitical risk as a significant driver of economic performance, while limited studies on the subject matter have argued the importance of geopolitical events on the economy (see Lee et al., 2021; Saint Akadiri et al., 2020; Tiwari et al., 2019; Wang et al., 2019) and on the environment (see Anser et al., 2021; Zhao et al., 2021).

South Africa has had its share of geopolitical events, globalization and carbon emissions over the years, with the nation being the 12th largest emitter of greenhouse gases including fluorinated gases, nitrous oxide, methane, water vapor and carbon dioxide (CO_2). Figures 1 and 2 provide graphical plots of the patterns among the series over the sampled period. It is paramount to state here that empirical literature on geopolitical risk is limited. Thus, this study is an addition to literature, as findings from this study would provide policymakers with useful information on the danger of geopolitical risk on the environment, for both the immediate and the future generations in South Africa and the entire African continent.

Furthermore, the influence of geopolitical risk on carbon emissions (environmental degradation) produces diverse outcomes. In some schools of thought (Jiao et al., 2022; Tomiwa et al., 2022; Anser et al., 2021; Sweidan, 2021), geopolitical risk positively impacts (escalates) environmental degradation. They are of the opinion that increase in geopolitical risk endangers the environment. Riti et al. (2022), in their study of BRICS countries, find that geopolitical risk positively impacts environmental degradation at aggregate level, and inversely relates with environmental degradation at the disaggregated level. This is in line with the findings of Zhao et al. (2021) that geopolitical risk negatively influences environmental degradation, while some other authors (such as Saint Akadiri et al., 2020) find no significant relationship among the series. In terms of globalization, Güngör et al. (2021) and Akadiri et al. (2020a, 2020b), using the autoregressive distributed lag model (ARDL), conclude that globalization exerts a negative impact on environmental degradation in South Africa. This outcome corroborates that of Baloch

[1] For a detailed literature review on geopolitical risk, globalization and carbon emissions, please see Anser et al. (2021), Zhao et al. (2021) and Salahuddin et al. (2019). For brevity, we could not delve into a detailed analysis on the subject matter.

et al. (2021) for OECD countries. On the other hand, Usman et al. (2020) via ARDL model, Le and Ozturk (2020) using second-generation panel techniques, and Farooq et al. (2022) all conclude that globalization (either economic or political) influences environmental degradation in the United States. These studies resonate with the findings of Adebayo et al. (2022), Akadiri and Adebayo (2021), Uzuner et al. (2020) and Saint Akadiri et al. (2019a). However, Saint Akadiri et al. (2019b), using ARDL model, find no significant impact of globalization on environmental degradation in Turkey. Most of the studies do not examine collectively the impact of geopolitical risk and globalization on environmental degradation in a multivariate study, using the advanced quantiles approach. This study therefore seeks to fill the identified gap.

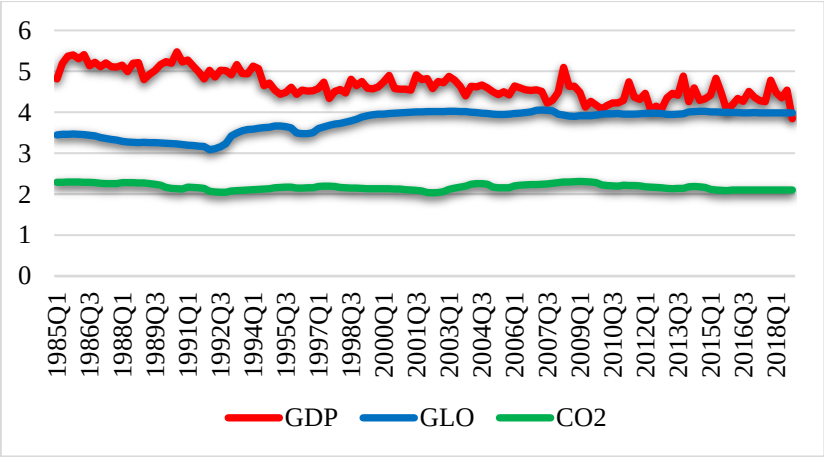

Figure 1. Trend of log of geopolitical risk, globalization and carbon emissions.

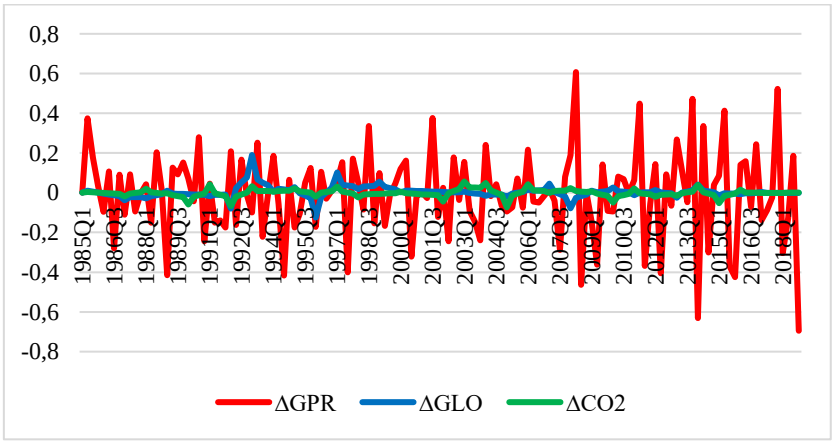

Figure 2. Trend of log difference of geopolitical risk, globalization and carbon emissions.

Salahuddin et al. (2019), in their empirical investigation, examine the nexus among urbanization, globalization and carbon emissions in South Africa over the period 1980-2017. For empirical analysis, the study makes use of the ARDL cointegration model for estimation and Toda-Yamamoto causality technique for testing predictive ability. Having confirmed a long-run equilibrium relationship among the series, further empirical results show that urbanization and globalization index both influence carbon emissions in the long run, while no predictive relationship is confirmed among the series. The study recommends the use of renewable energy in the South African energy mix for a renewable energy-based sustainable environment. This current paper is an improvement on the study. We make use of a relatively newly developed advanced Granger causality technique as proposed by Troster (2018), since the conventional mean causality approach does not consider possible dependence in the conditional tail of the distribution.

As discussed earlier, this current study seeks to investigate the effects of geopolitical risk and globalization on environmental degradation in South Africa over the period 1985Q1-2018Q4. Based on the authors' knowledge, this study is the first or among the scanty studies on the interaction and interconnectedness among geopolitical risk, globalization and environmental degradation (carbon emissions) in South Africa. This study improves on the existing study of Salahuddin et al. (2019) on globalization in South Africa and raises concerns on the potential impact of geopolitical risk on the environment of the sampled country, which based on our knowledge, is limited. This study deviates from the existing studies that make use of the mean causality approaches that do not consider

possible dependence in the conditional tail of the distribution. To examine whether the causality exists across the distribution, the novel Troster (2018) Granger non-causality in condition quantiles that captures the pattern of causality in various quantiles is used.

Empirical results show that there is feedback causality nexus between geopolitical risk and CO_2 emissions. In majority of the quantiles, feedback causality is also observed between globalization and CO_2 emissions. From a policy standpoint, using advanced quantile Granger causality techniques, this study has been able to substantiate that environmental degradation is not driven by globalization and geopolitical risk in the sampled country. However, policymakers must prevent heightened geopolitical risk and put in place stringent policies that would prevent adverse effects of globalization on the environment.

The rest of this study is outlined as follows. Section 2 discusses the literature review in brief. Section 3 presents the data and methodology adopted for empirical analysis. Section 4 presents the empirical results, followed by a discussion of findings. Section 5 proffers concluding remarks with potential policy suggestions for emerging economies, most specifically South Africa.

2. Data and Methods

2.1. Data

The major aim of this study is to examine the interaction and interconnectedness among geopolitical risk, globalization and environmental degradation in South Africa over the period 1985-2018. In addition, we seek to test whether geopolitical risk and globalization index contribute to environmental degradation level in the sampled country. To effectively achieve this objective, we employ the advanced and newly developed quantile technique as proposed by Troster (2018), using quarterly time series dataset. Data on geopolitical risk and globalization are sourced from Caldara and Iacoviello (2017) and Gygli et al. (2018), while data on carbon emissions metric tons per capita is sourced from the World Bank Development Indicators.

2.2. Unit root and quantile cointegration

We examine the stationarity properties of the series via the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The novelty of this paper is based on the use of an advanced quantile approach to examine the impact of various frequencies of geopolitical risk and globalization on the shapes, locations and scales of environmental degradation in South Africa. In line with the study of Mishra et al. (2019), this current study uses the quantile cointegration test proposed by Xiao (2009)[2] to examine the effects of geopolitical risk and globalization on environmental degradation across various frequencies. This technique circumvents the endogeneity limitations of traditional cointegration models by disintegrating the random disturbances of the cointegration equation into a pure innovation term and lead-lag terms. The Xiao (2009) quantile cointegration test is given as follows:

$$V_t = \varphi + \pi' Q_t + \sum_{j=-k}^{k} \Delta z'_{t-j} \beta_j + \upsilon_t \quad (1)$$

and

$$Y_{\omega}^{V}(V_t|I_t^V \,.\, I_t^z) = \varphi(\omega) + \pi(\omega)'^{Q_t} + \sum_{j=-k}^{k} \Delta z'_{t-j} \beta_j + H_u^{-1}(\omega) \quad (2)$$

A quadratic term of the predictor is added to the quadratic cointegration model as follows:

$$Y_{\omega}^{V}(V_t|I_t^V \,.\, I_t^z) = \varphi(\omega) + \pi(\omega)'^{Q_t} + \vartheta(\omega)' z_t^2 + \sum_{j=-k}^{k} \Delta z'_{t-j} \beta_j + \sum_{j=-k}^{k} \Delta z_{t-j}^{2'} \phi_j H_u^{-1}(\omega) \quad (3)$$

The null hypothesis is given as $H_0 = \pi$, across all quantiles. Thus, this current study uses the rule of Mishra *et al.* (2019) as a test statistic across all quantiles and conducts 1000 Monte Carlo simulations to estimate the critical values of the test statistic.

2.3. Q-Q Regression

For sound empirical analysis, this study makes use of the quantile-on-quantile regression (QQR) method. This advanced quantile method is robust for analyzing the connection between macroeconomic series outside the mean of the data. The QQR method was advanced by Sim and Zhou (2015) and it combines nonparametric estimation with the quantile regression. It is an addition to the Koenker and Bassett Jr. (1978) quantile technique as it povides a more inclusive description of the relations among series. The QQR examines the impact of geopolitical risk and globalization on carbon emissions, not only on the conditional mean of the explained series but also on its quantiles. This offers a more complete linkage when compared with the least squares method. In addition, as suggested by Cleveland (1979) and Stone (1977), traditional linear regression is useful when estimating the exact quantile of the explanatory series on the explained series. Therefore, to examine the role across quantiles of the explanatory series on diverse quantiles of the explained series, we combine standard quantile regression with linear regression. This will enhance empirical outcomes and provide a basis on which to comprehend the hidden nexus among the series under investigation.

[2] Xiao (2009) is an extension of the Engle and Granger (1987) test.

To empirically examine the linkages and impacts of geopolitical risk and globalization on environmental degradation in South Africa, the QQR approach is used to investigate the influence of different quantiles of X on the various quantiles of Y. The model is expressed as follows:

$$Y\_t = Y\hat{}\theta(X\_t) + \varepsilon\_t\hat{}\theta \quad (4)$$

Where Y_t is the explained series in period t and X_t is the explanatory series in time t. θ depicts the θth quantile on the distribution of X. Furthermore, μ_t^θ is the quantile error term, where the estimated θth quantile is equal to zero (0). In addition, bandwidth selection is crucial because it aids to shorten the target point and shifts the outcome's speed. If the bandwidth 'h' is wide, the variance will decrease, while the estimate deviation will also decrease, and vice versa. We thus make use of bandwidth value of h = 0.05 as suggested by Sim and Zhou (2015).

2.4. Quantiles Granger causality

We use the Troster (2018) causality test to detect the causal relationship among geopolitical risk, globalization and environmental degradation in South Africa. As suggested by Granger (1969), if Xi does not cause Zi, it implies that there is no causal linkage between Xi and Zi. If vector $\left(\mathcal{M}_i = \mathcal{M}_i^{\mathcal{Z}}, \mathcal{M}_i^{\mathcal{X}}\right) \in \Re^e, e = o + q$, with $\mathcal{M}_i^{\mathcal{X}}$ is the past proof of set of $\mathcal{X}_i$ $\mathcal{M}_i^{\mathcal{X}} = (\mathcal{X}_{i-1,} \dots \dots \mathcal{X}_{i-q,})' \in \Re^q$. Furthermore, equation 5 shows the H_o hypothesis:

$$\mathcal{H}_o^{\mathcal{X}\nrightarrow\mathcal{Z}}: \mathcal{FZ}\left(\mathcal{Z}\middle|\mathcal{M}_i^{\mathcal{Z}}, \mathcal{M}_i^{x}\right) = \mathcal{FZ}\left(\mathcal{Z}\middle|\mathcal{M}_i^{\mathcal{Z}}\right) \text{for all } \mathcal{X}\epsilon\Re, \quad (5)$$

$\mathcal{FZ}\left(.\middle|\mathcal{M}_i^{\mathcal{Z}}, \mathcal{M}_i^{x}\right)$ is observed as the conditional scattering function of $\mathcal{Z}i$ as long as $\mathcal{M}_i^{x}, \mathcal{M}_i^{z}$ in the domain of Ho shown by eq. 5. Based on the Troster (2018) research work, in evaluating Dt test which captures the QA (·) framework for all $\pi\in\Gamma\subset[0,1]$. Below is an illustration.

$$QAR(1): m_1\left(\mathcal{M}_i^{\mathcal{Z}}\middle|\partial(\pi)\right) = \lambda 1(\pi) + \lambda 2(\pi)\mathcal{Z}_{i-1} + \mu t\psi_{\mathcal{X}}^{-1}(\pi) \quad (6)$$

Where the values ∂here the val(π)and e re-evaluated by the supreme probability in quantiles grid space that is equal, and $\psi_{\mathcal{X}}^{-1}(.)$ is the opposition to a traditional dispersion function. We further amend the sign between the series via evaluating the QAF model in eq. 6 with the lagged parameter set to another value. We reveal the QAR in eq. 7:

$$\mathcal{Q}_{\pi}^{\mathcal{Z}} = \left(\mathcal{Z}_i\middle|\mathcal{M}_{\mathrm{i}}^{\mathcal{Z}}, \mathcal{M}_{\mathrm{i}}^{\mathrm{x}}\right) = \lambda 1(\pi) + \lambda 2(\pi)\mathcal{Z}_{i-1} + \eta(\pi)\mathcal{X}_{i-1} + \mu t\psi_{\mathcal{X}}^{-1} \quad (7)$$

3. Results and Discussion of Findings

Table 1 presents the data summa. The skewness value reports that carbon emissions, globalization and geopolitical risk are positively skewed. The Kurtosis value also reports that all the variables are leptokurtic, while CPU is platykurtic. In addition, the Jarque-Bera (JB) test statistic reveals that all the series are non-normal. We test for stationarity properties of the series using the conventional augmented Dickey-Fuller (ADF) and Philip-Perron (PP) unit root tests. The outcomes are reported at the right-hand side of Table 1. From the results, we find that all the series are integrated at first difference *I*(1).

Table 1. Descriptive Statistics and Unit Root Test Outcomes

	Descriptive Statistics								Unit Root Tests	
	Mean	Median	Max	Min	SD	Skewness	Kurtosis	JB	ΔADF	ΔPP
CO_2	8.8242	8.6907	10.0776	7.6479	0.6450	0.3183	2.0519	7.3901**	-4.559*	-5.909*
GLO	44.4801	51.890	57.7485	21.897	11.665	-0.6146	1.7263	17.7556*	-4.828*	-5.319*
GPR	113.450	99.414	239.2361	46.697	41.430	0.9039	3.0765	18.5540*	-6.875*	-4.361*

*Note: * and ** denote 1% and 5% levels of significance respectively.*

Having established the nonlinearity properties of the series, the BDS test as proposed by Broock et al. (1996) is then employed to identify the series' nonlinearity features. The BDS nonlinearity test results are reported in Table 2. From the results, we confirm the nonlinearity feature of all the series. These results reinforce the JB test statistic results reported in Table 1. The use of linear econometric techniques (such as ARDL, FMOLS, CCR, VECM, OLS) thus becomes inappropriate and would generate outcomes that are spurious or misleading. Consequently, this paper employs nonlinear techniques, such as quantile cointegration advanced by Xiao (2009) to confirm the cointegration relation among the series.

Table 2. BDS Test

	Z-stat (Pvalue)	Z-stat (Pvalue)	Z-stat (Pvalue)
M2	38.685*	37.825*	18.198*
M3	40.025*	40.073*	20.665*
M4	41.635*	42.936*	22.594*
M5	44.269*	47.206*	24.876*
M6	48.244*	53.042*	27.838*

*Note: * denotes significance level of 1%.*

Table 3 reports the cointegration test results among the series. Based on the results, we observe that the cointegration vector shifts across the distribution. We find an evidence of a long-run cointegration relation among carbon emissions, globalization and geopolitical risk for the sampled country. Thus, we conclude that in South Africa, the series under investigation have a common pattern of movement in the long run.

Table 3. Quantile Cointegration Test Outcomes

Model	Coefficient	$Sup_{\tau}\|V_{\pi}(\tau)\|$	CV1%	CV5%	CV10%
$\mathbf{CO_{2t}}$ **Vs** $\mathbf{GPR_t}$	β	8947.43	5128.84	3973.66	2963.25
	α	825.680	537.479	418.843	198.874
$\mathbf{CO_{2t}}$ **Vs** $\mathbf{GLO_t}$	β	7579.85	3980.85	2275.53	1785.84
	α	618.963	356.284	269.974	143.363

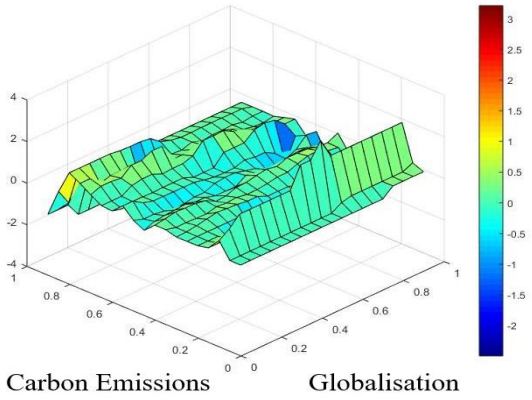

Figure 3. Effect of Globalization on CO_2

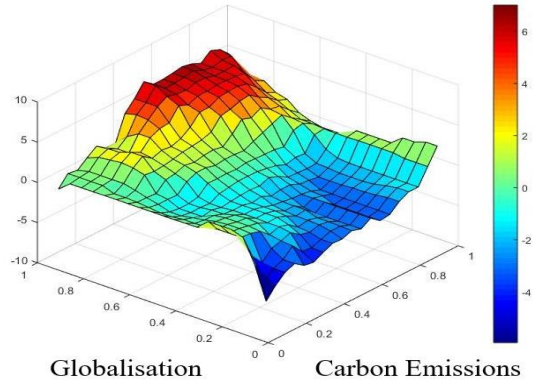

Figure 4. Effect of CO_2 on Globalization

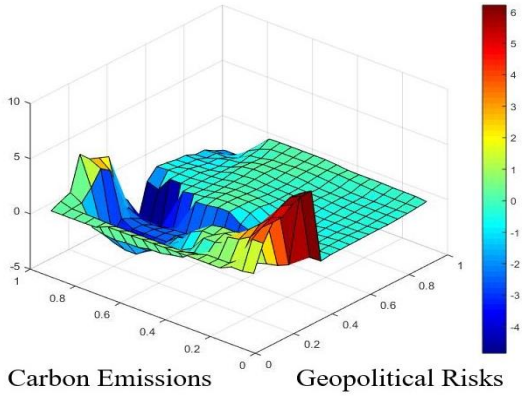

Figure 5. Effect of CO_2 on Geopolitical Risks

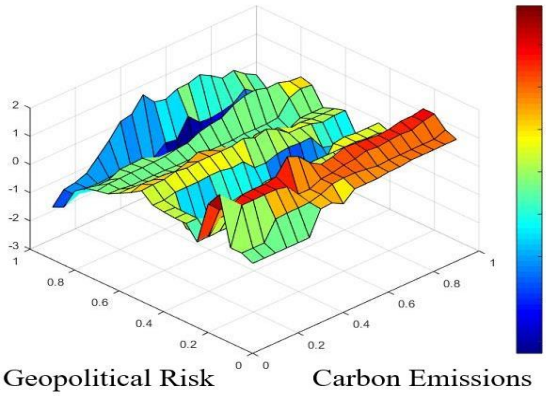

Figure 6. Effect of Geopolitical Risks on CO_2

Figures 3-6 report the effects of the series on one another. The figures are virtual representations of the existing predictive relationships among the series in 3D graphical plots. We further make use of the S_T Granger causality in quantiles test. Table 4 reports S_T and the probability values for the natural logarithms of the series. Note that the S_T Granger causality test is conducted for an equally spaced grid of nineteen (19) quantiles T, precisely between 0.05-0.95 respectively. Summarily, across the quantiles (0.10-0.95), the effect of globalization on CO_2 emissions is negative. While in the lower and middle quantiles (0.1-0.65), the effect of CO_2 emissions on globalization is negative, it is positive in the upper tail (0.70-0.95). This outcome is at variance with the study of Salahuddin *et al.* (2019) which finds no causal relation between globalization and carbon emission in South Africa.

In addition, in all quantiles (0.25-0.95), the effect of geopolitical risk on CO_2 emissions is negative, with the exemption of the lower tail (0.1-0.20) which shows slight evidence of a positive effect of geopolitical risk on CO_2 emissions. These findings resonate with the study of BRICS by Zhao et al. (2021), where it is confirmed that geopolitical risk inversely relates with carbon emissions in Russia and South Africa. Also, in the lower tail (0.1-0.25), the effect of CO_2 on geopolitical risks is positive; however, it is negative in the middle and upper quantiles. Overall, results show that there is feedback causality nexus between geopolitical risk and CO_2 emissions. In majority of the quantiles, feedback causality is likewise observed between globalization and CO_2 emissions.

Table 4. Granger Causality in Quantiles Outcomes

Quantiles	GPR→CO_2	CO_2→GPR	GLO→CO_2	CO_2→GLO
0.05	0.0102	**0.0102**	**0.0102**	**0.0102**
0.05	0.2688	0.3501	**0.0204**	0.2959
0.10	0.1290	0.1022	**0.0102**	**0.0102**
0.15	0.1398	0.4526	**0.0102**	**0.0102**
0.20	0.0645	**0.0102**	**0.0102**	**0.0102**
0.25	0.0753	**0.0102**	**0.0102**	**0.0102**
0.30	0.5806	**0.0102**	**0.0102**	0.4358
0.35	0.0108	**0.0102**	**0.0102**	0.1222
0.40	0.2366	0.0664	**0.0102**	0.3162
0.45	0.4301	0.1258	0.2755	0.1735
0.50	0.5591	0.9796	0.0612	0.7245
0.55	0.4194	0.1163	**0.0102**	**0.0102**
0.60	0.2366	0.0508	**0.0102**	**0.0408**
0.65	0.1720	**0.0102**	**0.0102**	0.5592
0.70	0.2903	**0.0102**	**0.0102**	0.4312
0.75	0.1935	**0.0102**	**0.0102**	**0.0102**
0.80	**0.0108**	**0.0102**	**0.0102**	**0.0102**
0.85	0.0538	**0.0102**	**0.0102**	**0.0102**
0.90	**0.0102**	**0.0102**	**0.0102**	**0.0102**
0.95	**0.0102**	0.6224	0.4592	0.3163

Table 4 unveils the sub-sampling pvalues of the DT test. The dismissal of the null hypothesis at the 5% significance level is illustrated in bold.

4. Concluding Remarks

This paper examines the interaction and interconnectedness among geopolitical risk, globalization and environmental degradation in South Africa over the period 1985Q1-2018Q4. In addition, we test whether geopolitical risk and globalization index contribute to the environmental degradation level in the sampled country. To effectively achieve this objective, we employ an advanced and newly developed quantile technique as proposed by Troster (2018), using quarterly time series dataset. We confirm the nonlinearity of the series, using the BDS test, which affirms that the series are nonlinear in nature, while the unit root confirms that the series are integrated at first difference. The results of the quantile cointegration also confirm the existence of a long-run equilibrium relation among quantiles of geopolitical risk, globalization and carbon emissions respectively. Additionally, we employ the novel Granger causality technique to ascertain the direction of causality in quantiles of the observed series, specifically in extreme fluctuations.

Overall, results show that there is feedback causality nexus between geopolitical risk and CO_2 emissions. In majority of the quantiles, feedback causality between globalization and CO_2 emissions is also observed. Thus, there is a bi-directional Granger causality nexus between geopolitical risk and environmental degradation as well as between globalization and environmental degradation. Empirical findings substantiate the dynamic nexus among geopolitical risk, globalization and environmental degradation in South Africa. We find that both globalization and geopolitical risk negatively influence environmental degradation in the sampled country. Summarily, using the advanced quantile Granger causality technique, this study has been able to substantiate that environmental degradation is not driven by globalization and geopolitical risk in the sampled country. However, policymakers should avoid heightened geopolitical risk and put in place stringent policies that would prevent adverse effects of globalization on the environment. We are of the opinion that policies that support green economy should be pursued to control the adverse effects of globalization and geopolitical risk, since a greener economy can be a useful weapon to buffer against potential globalization and geopolitical risks for oil and gas exporting/importing nations of Africa, most especially South Africa.

Conclusively, this study is confined to South Africa because the available geopolitical risk data does not cover all African countries. In addition, due to data availability, we could not capture the impact of COVID-19 pandemic in this study. As posited in Abubakar et al., (2021) COVID-19 exercise indirect effects, towards sustainable environment. It net impact on the environment has been positive; in terms of reduction in oil exploration activities, pollution and greenhouse emissions respectively. Thus, future researches may focus on examining the interactions among the observed series for Africa at large by incorporating the COVID-19 pandemic, to substantiate and further strengthen findings from this study in this new normal . Also, the use of more advanced methods, such as econometric techniques that capture regime switch, is suggested to carry out future studies.

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