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Impact of External Debt and Energy Consumption on Environmental Quality in Somalia

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ABSTRACT

This study investigates the interconnections between external debt, energy consumption, industrialization, and environmental quality in Somalia over the period 1990-2019, utilizing the ARDL bounds testing approach. Notably, a positive correlation is found between energy consumption and CO_2 emissions, emphasizing the imperative for sustainable practices. In the long run, external debt is observed to have an insignificant impact on environmental quality, suggesting a strategic opportunity for policymakers to channel external funds towards environmentally sustainable projects. Short-term strategies underscore the positive link between decreased industrialization and improved environmental quality, while a cautious approach to external debt is crucial due to its short-term negative impact. The significance of the error correction term underscores the need for adaptive policies. Overall, the study advocates for comprehensive policies integrating sustainable practices and directing external financing towards eco-friendly projects, alongside a capacity building and technology transfer partnerships for environmentally conscious development in Somalia.

Keywords: External Debt, Energy Consumption, Industrialization, CO_2, Autoregressive Distributed Lag
JEL Classifications: P18, F64, H63

1. INTRODUCTION

Climate change and global warming threaten human well-being and global ecosystems. A consensus among numerous researchers points to the escalating levels of CO_2 emissions, primarily driven by human activities such as plastic production, fossil fuel combustion, overpopulation, overhunting, deforestation, stream depletion, over-exploitation of natural resources, and reef destruction, as the key contributors to global warming and ecological imbalances (Bilgili et al., 2021; Nathaniel and Adedoyin, 2021; Warsame et al., 2023). Unfortunately, the trajectory of CO_2 emissions has surged to alarming levels over the years, with no discernible signs of abatement (Liu et al., 2022). Despite the persistent advocacy for reducing CO_2 emissions, the challenge remains in devising strategies to effectively curb emissions without compromising sustainable economic development, particularly in developing economies.

Climate change exhibits disproportionate impacts across global regions, with a heightened vulnerability observed in many developing countries. The latest report from the Intergovernmental Panel on Climate Change (IPCC) underscores that the African continent, particularly, is witnessing an escalation in extreme weather events, projected to intensify over the coming decade (IPCC, 2022). Adding complexity to the situation, Africa's susceptibility is compounded by a heavy reliance on fossil fuels, as highlighted by the fact that 80% of electricity generation on the continent is fossil fuel-based, despite ambitious plans for renewable energy development and the abundant potential for solar, wind, and geothermal resources (IEA, 2021).

In the unique context of Somalia, a nation marked by distinctive challenges and aspirations, pursuing renewable energy projects emerges as a pivotal yet dynamic endeavour. Despite this, Somalia contends with a considerable reliance on fossil fuels to meet the surging demands for electricity. The country's susceptibility to the repercussions of climate change is exacerbated by this dependence, notwithstanding its minimal contribution of a mere 0.16% to the global greenhouse gases (GHG) inventory (UNDP, 2022). The critical issue of urban expansion in Somalia intensifies energy requirements while presenting challenges linked to pollution and the strain exerted on natural resources (Warsame et al., 2023, Hassan et al., 2023, Warsame and Mohamed 2024).

Against the backdrop of prolonged civil wars in Somalia, the decline in the foreign exchange earning capacity of the economy has been further exacerbated. This has adversely impacted Somalia's ability to service its debt, resulting in the swiftly accumulating arrears. The imperative to rehabilitate the war-torn economy compelled the government to resort to external financing, leading to a significant rise in the debt stock by 1987. By June 1993, the outstanding and disbursed debt had reached US$2.5 million, with arrears amounting to US$253 million. Despite a reduction from the June 1984 level of US$149.3 million, this stock of arrears triggered legal actions against the government. It effectively compromised its capacity to manage economic stability (World Bank, 2008). In 2014, external debt was estimated at US$5.3 billion, constituting 93% of GDP, primarily in arrears. Debt data encompasses obligations to multilateral (US$1.5 billion), Paris Club creditors (US$2.3 billion), and Non-Paris Club creditors (US$1.5 billion), with a preliminary assessment suggesting Somalia's inability to service its debt in the medium term (IMF Article IV, 2015).

Despite these economic challenges, the responsibility for electricity provision in Somalia has predominantly rested with the thriving private sector since the collapse of the central government in 1991. Presently, the total production capacity stands at approximately 106 Megawatts. Although gasoline power plants remain prevalent in electricity generation, there is a growing interest and investment in hybrid systems harnessing renewable sources like solar and wind. Recent research by the African Development Bank indicates that Somalia possesses the most tremendous resource potential for coastal wind power in Africa, with the capacity to produce between 30,000 and 45,000 Megawatts. Moreover, solar panels have the potential to generate over 2000 kWh/m^2 of energy.

In the current body of research exploring the impact of external debt and energy consumption on environmental quality, a substantial gap exists regarding the specific context of Somalia. While numerous studies have investigated similar relationships in more stable economies, fragile and conflict-affected states such as Somalia remain underrepresented. The unique challenges stemming from Somalia's political instability, limited infrastructure, and competing development priorities suggest that the influence of external debt on energy consumption and subsequent emissions might vary significantly. This gap in the literature underscores the need for a tailored and localized analysis to comprehensively understand the intricate interplay between external debt, energy usage, and emissions in Somalia, which is crucial for informing targeted policies to mitigate environmental degradation and promote sustainable development.

Finally, reliable estimation methods based on Auto Regressive Distributive Lag ARDL provide more extensive scheme suggestions from Somalia's external debt and emissions. The paper is structured as follows: Section 2 reviews the relevant literature, Section 3 describes the research methodology and data, Section 4 presents the study's findings, and Section 5 concludes with policy implications.

2. LITERATURE REVIEW

The relationship between external debt and emissions has garnered increasing attention recently as countries grapple with the dual challenges of economic development and environmental sustainability. While the literature on this topic is still evolving, several studies have shed light on the complex interactions between external debt, economic growth, and environmental degradation.

A central theme emerging from the literature is the potential for external debt exacerbating environmental problems. Studies by (Beşe et al., 2021a; 2021b; Akam et al., 2022; Katircioglu and Celebi, 2018; Zeraibi et al., 2023; and Zhao and Zhixin, 2022) all provide evidence that external debt can lead to increased emissions. This is partly because external debt can finance environmentally damaging activities, such as exploiting natural resources or constructing energy-intensive infrastructure.

However, the relationship between external debt and emissions is not always straightforward. Some studies have found that external debt can positively impact environmental sustainability, mainly when used to fund renewable energy projects or environmental protection initiatives. For instance, Bese et al. (2020) found that external debt positively reduced methane gas emissions in China.

The impact of specific types of external debt on emissions is also worth exploring. The study by Bachegour and Qafas (2023) found that private external debt significantly impacts CO_2 emissions in Morocco more than public external debt. This suggests that using external debt for private investment may pose more significant environmental risks.

Numerous studies have established a direct positive relationship between energy consumption and CO_2 emissions, emphasizing the role of energy use in contributing to greenhouse gas emissions. For instance, research by Warsame et al. (2023) found a significant positive correlation between energy consumption and CO_2 emissions in Somalia, highlighting the need for targeted policies to address the environmental consequences of rapid industrialization and increased energy demand. Similarly, work by Muhammad (2019) on a global scale confirmed a positive and statistically significant relationship between energy consumption and CO_2 emissions, emphasizing the global nature of this environmental challenge. These findings are consistent with the conclusions of other studies, such as those by (Jalil and Mahmud, 2009; Zhang and Cheng, 2009; Ang, 2007; and Apergis and Payne, 2010), underlining the universality of the impact of energy consumption on CO_2 emissions across various regions and economic contexts.

In conclusion, the relationship between external debt and emissions is complex and multifaceted, influenced by economic, environmental, and institutional factors. While external debt can exacerbate environmental problems, it can also contribute to environmental sustainability when used judiciously. Further research is needed to fully understand the nuances of this relationship and develop effective policy strategies to mitigate the negative environmental impacts of external debt while harnessing its potential for environmental improvement.

3. METHODOLOGY

The study examines the effect of external debt and energy consumption on Environmental quality in Somalia. A time series of data from 1990 to 2019 was employed from the World Bank, SESRIC and World Data. Three study variables were used in the study, which includes EC – energy-consumption (kilogram of oil equivalent per capita); CO_2 – carbon dioxide emissions (kt) proxy of environmental quality; IND – industry, value added (Constant 2015 US$), which is a proxy for Industrialization and ED – External debt (External Debt Stocks, Total [Current Prices in Thousands]).

A linear representation of the relationship between external debt, energy consumption, and carbon dioxide emissions in Somalia is shown in Eq. (1):

$$InCO2_t = F\,(InED_{t,}\ InIND_{t,}\ InEC_{t,}) \tag{1}$$

InECt, InCO2t, InINDt and lnED represent a natural logarithmic transformation of EC, CO_2, IND, and ED for a more stable data variance.

The empirical specifications for the model can be quantified as follows:

$$InCO2_t = \beta_0 + \beta_1\, InED_t + \beta_2\, InIND_t + \beta_3\, InEC_t + \varepsilon_t \tag{2}$$

where InCO2t is the dependent variable, while InEDt, InINDt, and lnEC are the explanatory variables in year t, εt is the error term, and β0, β1, β2, and β3 are the elasticities to be estimated.

The initial step in assessing cointegration involves scrutinizing the order of integration of the variables. Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) stationarity tests are applied to ascertain whether the series exhibits cointegration. Once the series achieves stationarity, the lag order is determined, and investigations are conducted to identify potential cointegrating relationships among the variables. Several cointegration tests are available for examining the long-run relationships among model variables. The widely employed Engle and Granger test, discussed extensively in the literature, applies specifically to variables with the same order of integration. Subsequently, alternative approaches have been developed, including Johansen's Error Correction Cointegration technique, which is more versatile than the Engle and Granger method; the Phillips and Ouliaris test; the Johansen and Juselius test; the Structural Error Correction Model proposed by Peter Boswijk (1994); and the test suggested by Banerjee et al. (1998a), which relies on the t-test for the null hypothesis. Criticism has been directed at these standard approaches for their perceived unreliability in small samples, inconsistency with different-order integrated variables, and susceptibility to yielding misleading and biased results against null hypothesis rejection (no-cointegration). Consequently, a more robust cointegration technique, the autoregressive distributed lag (ARDL) bounds testing approach, is employed to enhance test power. (Shahbaz et al., 2015). Hence, to increase the test power, a more robust cointegration technique is used, the autoregressive distributed lag (ARDL) bounds testing approach.

Following the empirical work of (Sarkodie and Adams, 2018 and Warsame & Mohamed, 2023), the ARDL cointegration equation can be written as:

$$\begin{aligned} \Delta InCO2_t &= +\alpha_0 + \beta_1 InED_{t-1} + \beta_2 InIND_{t-1} + \beta_3 InEC_{t-1} \\ &+ \sum_{i=0}^{q} \Delta\alpha_1 InCO2_{t-k} + \sum_{i=0}^{p} \Delta\alpha_2 InED_{t-k} + \\ &\sum_{i=0}^{p} \Delta\alpha_3 InIND_{t-k} + \sum_{i=0}^{p} \Delta\alpha_4 InEC_{t-k} + \varepsilon_{t-k} \end{aligned} \tag{3}$$

Where α0 represents the constant term, and α1 - α4 denote the coefficients for short-term variables, while β1 - β3 signify the elasticities of long-run parameters. The variable q denotes the optimal lags for the explained variables, p indicates the optimal lags for the explanatory variables, Δ represents the first difference sign illustrating short-run variables, and εt represents the error term.

The ARDL cointegration methodology initiates with bound testing, which is subsequently subjected to Ordinary Least Squares (OLS) regression. The null hypothesis (H0): β1 = β2 = β3 = 0 posits that the variables lack cointegration in the long run, whereas the alternative hypothesis (H1): β1 ≠ β2 ≠ β3 ≠ 0 suggests the presence of long-run cointegration among variables. Wald-F statistics and critical values are employed to assess the null hypothesis. Rejection of the null hypothesis, as indicated by Wald-F statistics surpassing the upper bound critical values, signifies that the variables are interconnected in the long run and vice versa.

4. RESULTS AND DISCUSSION

4.1. Descriptive Analysis and Correlation Matrix

The table provides a comprehensive overview of the descriptive statistics for key variables in a study examining "the impact of external debt and energy consumption on environmental quality in Somalia." The variables include $\ln CO_2$ (natural logarithm of carbon dioxide emission), lnEC (natural logarithm of energy consumption), lnIND (natural logarithm of industrialization), and lnED (natural logarithm of external debt). The mean values of these variables reveal central tendencies, with $\ln CO_2$ having an average value of 6.41, lnEC at 5.72, lnIND at 18.10, and lnED at 14.84. The median values, which represent the middle point of the data, are close to the means, indicating a relatively symmetric distribution.

Additionally, the table provides insights into the dispersion and shape of the data. The standard deviations for lnCO$_2$ and lnEC are relatively small, suggesting limited variability around the mean. At the same time, lnIND and lnED have larger standard deviations, indicating more variability in industrialization and external debt. Skewness measures the asymmetry of the distribution, with lnCO$_2$ and lnIND showing slight negative skewness while lnEC and lnED exhibit positive skewness. The Jarque-Bera statistic and associated P-values provide information about the normality of the data distribution. Notably, lnEC and lnED have significantly low P-values, indicating a departure from normality, which may affect statistical analyses. These descriptive statistics contribute to a comprehensive understanding of the critical variables and their distributions, setting the stage for further in-depth analyses and interpretations in the context of the study's overarching research question.

The correlation matrix reveals relationships between variables in the study on "the impact of external debt and energy consumption on environmental quality in Somalia." Notably, lnCO$_2$ (carbon dioxide emission) has a negligible correlation with lnEC (energy consumption) while showing a moderate positive correlation with lnIND (industrialization) and lnED (external debt). The negative correlations between lnEC and lnIND and lnEC and lnED suggest an inverse relationship between energy consumption, industrialization and external debt. These findings provide initial insights into the complex dynamics of environmental quality in Somalia, guiding further exploration of the relationships among the variables.

4.2. Unit Root Test

Ensuring the unit root properties is a prerequisite for time series modelling, particularly in autoregressive distributed lag (ARDL) analysis. Therefore, Augmented Dickey-Fuller (ADF) and Philips Perron (PP) tests were employed to mitigate the risk of spurious regression outcomes. The unit root analysis presented in Table 3 reveals that the natural logarithm of energy consumption (lnEC) is stationary at the level (I [0]), while the remaining series exhibit a unit root. Additionally, Table 3 indicates that the majority of the series are integrated at the first difference (I [1]), with only lnEC being integrated at (I [0]). As none of the variables demonstrate stationarity at the second difference (I [2]), the analysis proceeded to estimate the bounds test for cointegration.

Table 1: Descriptive statistics of variables

Stats	InCO$_2$	InEC	InIND	InED
Mean	6.412982	5.717328	18.10403	14.84088
Median	6.437720	5.719302	18.21404	14.82840
Maximum	6.593045	6.365248	19.03273	15.54208
Minimum	6.194405	5.427469	17.11777	14.62404
SD	0.100931	0.176867	0.627884	0.205157
Skewness	−0.514309	1.392708	−0.143373	2.589149
Jarque-Bera	1.446313	31.04760	2.508708	87.23198
P-value	0.485218	0.000000	0.285260	0.000000

Table 2: Correlation matrix

Stats	InCO$_2$	InEC	InIND	InED
InCO$_2$	1			
InEC	−0.0042	1		
InIND	0.2503	−0.7721	1	
InED	0.2751	−0.6443	0.6794	1

4.3. Cointegration Test

The table presents the results of the F-bounds test for cointegration, which is a crucial analysis in determining the long-term relationship between variables. The F-statistic of 9.60742 is compared against critical values at different significance levels (1%, 5%, and 10%). In this context, the null hypothesis is that there is no cointegration, while the alternative hypothesis suggests cointegration exists. If the F-statistic exceeds the critical value, the null hypothesis is rejected, indicating evidence of cointegration. The bounds test critical values provide thresholds for different significance levels. In this case, the F-statistic surpasses all critical values, implying a rejection of the null hypothesis at the 1%, 5%, and 10% significance levels. Therefore, the results suggest a long-term relationship between the variables under consideration in the study on "the impact of external debt and energy consumption on environmental quality in Somalia."

4.4. ARDL Long-run and Short-run Results with Diagnostics

Table 3: Unit root

Variables	T-statistics at level ADF	PP
InCO$_2$	−2.6577	−2.3434
lnEC	−7.4708***	−6.2445***
InIND	−2.2515	−2.2305
InED	−3.4277*	−2.2790
At first difference		
ΔInCO$_2$	−3.4250*	−3.4618*
ΔInIND	−5.9256***	−5.8817***
ΔInED	−4.9643***	−6.2965***

***, **, *Indicate the significance level at 1%, 5%, and 10%. Δ denotes the first difference operator. The T-statistics reported are the intercept and trend. ADF: Augmented Dickey-Fuller, PP: Philips Perron

Table 4: F bounds test

F-statistic	Level of significance (%)	Bounds test critical values I (0)	I (1)
9.60742	1	3.65	4.66
	5	2.79	3.67
	10	2.37	3.2

Table 5: Long-run results and diagnostics

Variables	Coefficient
C	6.8069
	(0.7319)
LnEC	0.7887
	(1.9281) *
LnIND	0.4192
	(3.2503) ***
LnED	−0.8418
	(−1.2783)
Reset test	2.8434 (0.1100)
Serial correlation	0.8369 (0.3603)
Heteroskedasticity	11.9524 (0.2160)
Normality	3.1461 (0.2074)

***, **,*Indicate significance levels at 1%, 5%, and 10%. The T-statistics are reported in (..)

The long-run estimations of the ARDL method are presented in Table 5, with some diagnostic test statistics. The study's findings gain added significance when considering the crucial interplay between economic variables and environmental quality, particularly in the context of CO_2 emissions. The coefficient of energy consumption, recorded at 0.7887 with a statistically significant t-statistic of 1.9281 at the 10% level, underscores a substantial positive relationship between energy consumption and carbon dioxide (CO_2) emissions. This signifies that heightened energy consumption is closely associated with increased CO_2 emissions, posing a significant concern for environmental quality. The statistical significance of the coefficient highlights the reliability of this relationship. As anything contributing to higher CO_2 emissions is recognized as detrimental to the environment, the findings emphasize addressing and mitigating the environmental impact of elevated energy consumption. Implementing energy-efficient and environmentally sustainable practices becomes crucial to curbing the adverse consequences on environmental quality associated with heightened energy consumption. This finding aligns with the results of (Shahbaz et al., 2014; and Ang, 2007).

The coefficient of industrialization, measured at 0.4192, signifies a positive correlation between industrialization and carbon dioxide (CO_2) emissions. This implies that as industrial activities increase, there is a corresponding rise in CO_2 emissions, potentially contributing to environmental degradation. Despite the positive aspects of industrialization, such as economic development, the emphasis lies in acknowledging and mitigating the adverse environmental impact. The coefficient value of 0.4192 indicates a moderate strength in this positive relationship, underscoring the importance of adopting sustainable and environmentally friendly industrial practices. In essence, managing and reducing CO_2 emissions becomes imperative to balance industrialization's benefits and prevent detrimental environmental consequences. This finding aligns with the findings of (Li and Lin, 2015; Zhu et al., 2017; and Dong et al., 2019).

Given the non-significant impact of external debt on environmental quality, it becomes crucial to explore how borrowing and financial decisions can be leveraged to promote sustainable practices. Countries like Somalia can potentially mitigate the adverse effects of external debt on CO_2 emissions by directing external funds towards environmentally friendly projects and initiatives. In conclusion, the study's implications extend beyond the specific variables analyzed, emphasizing the need for a holistic approach that considers the environmental consequences of economic activities, especially in the face of global climate change and environmental sustainability challenges.

Diagnostic check results show no serial correlation, heteroscedasticity, model misspecification, and normality problems in the ARDL model. Also, the coefficients of the ARDL model are found stable over the sample period according to the CUSUM and CUSUM-square tests, and test results are presented in Figures 1 and 2, respectively.

Finally, Table 6 presents coefficients and associated t-statistics for variables in a short-run analysis and the Error Correction Term

Figure 1: Cusum test

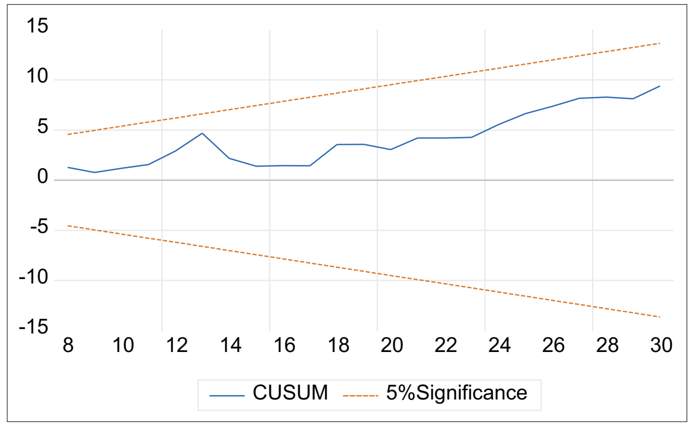

Figure 2: Cusum of squares

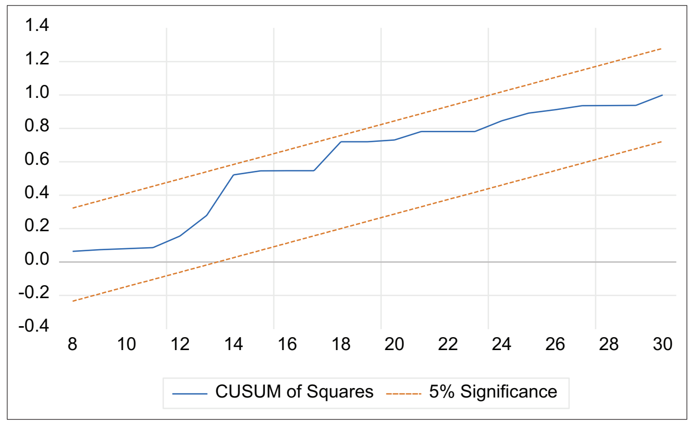

Table 6: Short-run results

Variables	Coefficient
ΔInEC	0.0399 (−0.4128)
ΔInIND	−0.0441 (−1.0480)
$\Delta InIND_{t-1}$	−0.1427 (−3.1559) ***
ΔInED	−0.0273 (−0.8294)
$\Delta InED_{t-1}$	0.2727 (6.5230) ***
ECT_{t-1}	−0.2592 (−7.6624) ***

***, **,*Indicate significance levels at 1%, 5%, and 10%. The T-statistics are reported in (..)

(ECT) in a model exploring the relationship between external debt, energy consumption, industrialization and environmental quality in Somalia. In the short run, the change in the lagged industrialization (ΔInINDt-1) and the lagged change in external debt (ΔInEDt-1) emerge as statistically significant variables.

The lagged change in industrialization (ΔInINDt-1) is characterized by a negative coefficient and a highly significant t-statistic (−3.1559), indicating a statistically significant positive impact on environmental quality in the short run. This suggests that a decrease in industrialization in the previous period is associated with improved environmental quality during the current period.

Similarly, the lagged change in external debt (ΔInEDt-1) exhibits a positive coefficient and a highly significant t-statistic (6.5230). This implies a statistically significant negative impact on environmental quality in the short run when external debt increases in the previous period.

The error correction term (ECTt-1) also has a highly significant negative coefficient (−7.6624), indicating that the model corrects for short-run deviations from the long-run equilibrium. This correction mechanism influences the variables, pulling them back toward their equilibrium relationship.

5. CONCLUSION AND POLICY IMPLICATIONS

The findings of this study shed light on the intricate dynamics between external debt, energy consumption, industrialization, and environmental quality in Somalia. The positive correlation between energy consumption and carbon dioxide (CO_2) emissions, as well as industrialization and CO_2 emissions, underscores the urgency of adopting sustainable practices. In crafting policies, it is imperative to consider the unique challenges faced by Somalia, a fragile state with a history of conflict and economic instability.

In the long run, the non-significant impact of external debt on environmental quality suggests an opportunity for strategic policy interventions. Policymakers can channel external funds towards projects that align with environmental sustainability, mitigating potential adverse effects. This emphasizes the need for a nuanced approach to external financing, ensuring that financial decisions contribute positively to Somalia's efforts to combat climate change.

In the short run, the study highlights actionable strategies. Decreased industrialization correlates positively with improved environmental quality, emphasizing the importance of responsibly managing industrial activities. Simultaneously, a careful approach to external debt is crucial, as an increase in debt is associated with a short-term negative impact on environmental quality. This indicates the necessity for reasonable borrowing decisions that align with environmental preservation goals.

The error correction term's significance in the short run reinforces the need for adaptive policies. It suggests that the model corrects for short-run deviations from the long-run equilibrium, emphasizing the importance of dynamic and responsive policymaking. Short-term strategies should balance economic development and environmental preservation, ensuring immediate gains in environmental quality without compromising long-term sustainability.

Furthermore, the policy implications extend beyond specific sectors. A comprehensive approach involves promoting sustainable practices, directing external financing towards environmentally friendly projects, and integrating environmental considerations into national development strategies. By doing so, policymakers can navigate the delicate balance between economic growth and environmental preservation.

Capacity building and technology transfer emerge as critical components of the policy landscape. Partnerships with international organizations and developed nations can facilitate acquiring and implementing environmentally friendly technologies. This collaborative approach aligns with the study's emphasis on holistic strategies, acknowledging that sustainable development requires a coordinated effort on both domestic and global fronts.

REFERENCES

Akam, D., Owolabi, O., Prince Nathaniel, S. (2022), Linking external debt and renewable energy to environmental sustainability in heavily indebted poor countries: New insights from advanced panel estimators. Environmental Science and Pollution Research, 28, 65300-65312.

Ang, J.B. (2007), CO_2 emissions, energy consumption, and output in France. Energy Policy, 35(10), 4772-4778.

Apergis, N., Payne, J.E. (2010), Renewable energy consumption and economic growth: Evidence from a panel of OECD countries. Energy Policy, 38(1), 656-660.

Available from: https://www.iea.org/reports/world-energy-outlook-2021

Available from: https://www.undp.org/africa/publications/undp-waca-annual-report-2022?gad_source=1&gclid=eaiaiqobchmiylqn84dqggmv7pgdbx18_wjmeaayasaaegicbfd_bwe

Available from: https://www.worldbank.org/en/publication/wdr2020

Bachegour, H., Qafas, A. (2023), Does external debt Worsen environmental pollution? Evidence from Morocco. International Journal of Energy Economics and Policy, 13(2), 68-76.

Banerjee, A., Dolado, J.J., Mestre, R. (1998), Error-correction mechanism tests for cointegration in a single-equation framework. Journal of Time Series Analysis, 19(3), 267-283.

Beşe, E., Friday, H.S. (2022), The effect of external debt on emissions from coal consumption: Evidence from Turkey. International Journal of Energy Economics and Policy, 12(5), 515-518.

Bese, E., Friday, H.S., Özden, C. (2020), The effect of external debt on emissions: Evidence from China. International Journal of Energy Economics and Policy, 11(1), 440-447.

Bese, E., Friday, H.S., Ozden, C. (2021a and b), Is India financing its emissions through external debt? International Journal of Energy Economics and Policy, 11(6), 170-179.

Bilgili, F., Lorente, D.B., Kuşkaya, S., Ünlü, F., Gençoğlu, P., Rosha, P. (2021), The role of hydropower energy in the level of CO_2 emissions: An application of continuous wavelet transform. Renewable Energy, 178, 283-294.

Dong, F., Wang, Y., Su, B., Hua, Y., Zhang, Y. (2019), The process of peak CO_2 emissions in developed economies: A perspective of industrialization and urbanization. Resources, Conservation and Recycling, 141, 61-75.

Jalil, A., Mahmud, S.F. (2009), Environment Kuznets curve for CO_2 emissions: A cointegration analysis for China. Energy Policy, 37(12), 5167-5172.

Katircioglu, S., Celebi, A. (2018), Testing the role of external debt in environmental degradation: Empirical evidence from Turkey. Environmental Science and Pollution Research, 25(9), 8843-8852.

Li, K., Lin, B. (2015), Impacts of urbanization and industrialization on energy consumption/CO_2 emissions: Does the level of development matter? Renewable and Sustainable Energy Reviews, 52, 1107-1122.

Liu, Z., Deng, Z., Davis, S.J., Giron, C., Ciais, P. (2022), Monitoring global carbon emissions in 2021. Nature Reviews Earth and Environment, 3(4), 217-219.

Mohamud, I. H., Mohamud, A.A. (2023), The impact of renewable energy consumption and economic growth on environmental degradation in Somalia. International Journal of Energy Economics and Policy, 13(5), 533-543.

Muhammad, B. (2019), Energy consumption, CO_2 emissions and economic growth in developed, emerging and Middle East and North Africa countries. Energy, 179, 232-245.

Nathaniel, S.P., Adedoyin, F.F. (2021), The role of income, trade, and environmental regulations in ensuring environmental sustainability in MINT countries: Evidence from ecological footprint. Estudios de Economia Aplicada, 39(8), 4173.

Peter Boswijk, H. (1994), Testing for an unstable root in conditional and structural error correction models. Journal of Econometrics, 63, 37-60.

Sarkodie, S.A., Adams, S. (2018), Renewable energy, nuclear energy, and environmental pollution: Accounting for political institutional quality in South Africa. Science of the Total Environment, 643, 1590-1601.

Shahbaz, M., Khraief, N., Jemaa, M.M.B. (2015), On the causal nexus of road transport CO_2 emissions and macroeconomic variables in Tunisia: Evidence from combined cointegration tests. Renewable and Sustainable Energy Reviews, 51, 89-100.

Shahbaz, M., Uddin, G.S., Rehman, I.U., Imran, K. (2014), Industrialization, electricity consumption and CO_2 emissions in Bangladesh. Renewable and Sustainable Energy Reviews, 31, 575-586.

Warsame, A.A., Sarkodie, S.A. (2022), Asymmetric impact of energy utilization and economic development on environmental degradation in Somalia. Environmental Science and Pollution Research, 29(16), 23361-23373.

Warsame, Z.A. (2022), The significance of FDI inflow and renewable energy consumption in mitigating environmental degradation in Somalia. International Journal of Energy Economics and Policy, 13(1), 443-453.

Warsame, Z. A., Hassan, A.M., Hassan, A.Y. (2023). Determinants of Inflation in Somalia: An ARDL approach. Planning, 18(9): 2811-2817.

Warsame, Z.A., Mohamed Ali, M., Mohamud, L.B., Mohamed, F.H. (2023), The causal relation between energy consumption, carbon dioxide emissions, and macroeconomic variables in Somalia. International Journal of Energy Economics and Policy, 13(3), 102-110.

Warsame, Z. A., & Mohamed, I. S. A. (2023). Impact of foreign direct investment (FDI) on unemployment in Somalia. International Journal of Membrane Science and Technology, 10(3), 2256-2264

Warsame, Z. A., & Mohamed, I. S. A. (2024), On the determinants of unemployment in Somalia: What is the role of external debt?. International Journal of Sustainable Development and Planning, 19(1), 161-165.

Zeraibi, A., Radulescu, M., Khan, M.K., Hafeez, M., Jahanger, A. (2023), Analyzing the linkage between public debt, renewable electricity output, and CO_2 emissions in emerging economies: Does the N-shaped environmental Kuznets curve exist? Energy and Environment. https://doi.org/10.1177/0958305X231151678

Zhang, X.P., Cheng, X.M. (2009), Energy consumption, carbon emissions, and economic growth in China. Ecological Economics, 68(10), 2706-2712.

Zhao, T., Liu, Z. (2022), Drivers of CO_2 emissions: A debt perspective. International Journal of Environmental Research and Public Health, 19(3), 1847.

Zhu, Z., Liu, Y., Tian, X., Wang, Y., Zhang, Y. (2017), CO_2 emissions from the industrialization and urbanization processes in the manufacturing centre Tianjin in China. Journal of Cleaner Production, 168, 867-875.