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Investigating the Effect of Gross Capital Formation on Carbon Emissions in Somalia

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ABSTRACT

The advent of climate change has evolved into a paramount challenge for humanity, prompting extensive endeavors to mitigate its consequences. This research delves into the influence between gross capital formation (GCF) and carbon dioxide emissions in Somalia, spanning the years 1991-2019. To scrutinize the long-term associations among the variables under consideration, the study employed autoregressive distributed lag (ARDL) model. Additionally, to ensure the robustness of the study, both dynamic ordinary least squares and fully modified ordinary least squares were applied. Contrary to expectations, the findings indicate that GCF does not exert a significant influence on carbon dioxide emissions. The study advocates for the implementation of a comprehensive environmental policy framework that considers a spectrum of contributing factors beyond GCF. To address the multifaceted nature of environmental challenges, the study recommends initiatives such as diversification of energy sources, technology transfer, promotion of sustainable practices, and integration of climate resilience.

Keywords: Somalia, Gross Capital Formation, Climate Change, Autoregressive Distributed Lag
JEL Classifications: E22, Q56, E23, Q54

1. INTRODUCTION

Over the last few years, environmental issues have been widely discussed by scholars in the literature of environmental economics and other disciplines. However, the impact of the industrial revolution and infrastructural development is expected to lead to changes in the biodiversity of the globe (Abbas et al., 2020). The emission of greenhouse gases, particularly carbon dioxide emissions, is thought to be a main contributor to the phenomenon of global warming (Esso and Keho, 2016; Soytas and Sari, 2009).

Academics have extensively covered the literature regarding the increase in carbon dioxide emissions and its impact on economic development. Most researchers have found that greenhouse gas emissions tend to rise in the early phases of economic development. However, at some point, a threshold of expansion is achieved, and the degradation of the environment starts to recede (Dinda, 2004; MacDermott et al., 2019). This reveals an inverted U-shaped relationship among income growth and environmental pollution (Saraç and Yağlikara, 2017). The inverted U-shape was first proposed by Kuznets (1955), who theorized the connection between income disparity and economic development.

This initiative also makes sense in applying the relationship between environmental change and economic growth (Dinda, 2004). In the initial stage of the industrial modernization, CO_2 emissions tend to escalate because individuals prioritize producing more material goods and are more concerned with finding work and making a fortune than maintaining fresh air and water (Dasgupta et al., 2002). As affluence expands, citizens tend to value the environment more, and institutions implement anti-policies that discourage activities harmful to the ecosystem. This leads to a regression in the level of pollution in the atmosphere.

However, according to some environmental scholars, the primary environmental challenge lies in the country's energy utilization (Alam et al., 2016). The exploitation of energy usage not only results in significant pollution of the ozone layer but also escalates the cost of environmental emissions (Akpan and Akpan, 2012). Furthermore, developing nations are grappling with the dual challenge of aligning with sustainable development goals while pursuing high economic development that is also environmentally friendly (Meng et al., 2022).

In addition to energy consumption, other factors contribute to environmental problems, such as gross capital formation (GCF) and the influx of foreign direct investment (FDI) into developing countries. Subsequent influential studies by academics have emphasized a definite correlation between FDI and environmental pollution in developing nations (Kivyiro and Arminen, 2014; Rafindadi et al., 2018; Demena and Afesorgbor, 2020; Asiedu, 2021; Boamah et al., 2023).

GCF describes the accumulation of all physical assets with a lengthy lifespan, such as building infrastructures, transportation resources, a massive amount of equipment, and power plants/power stations (Maune and Matanda, 2022). The phrase is also applicable to the utilization of both human and material capital, involving investments in education and skills (Bharti & Yang 2021; Kusmadi, 1997). GCF represents one of the key variables that determine economic development, particularly for developing nations (Södersten et al., 2017; Rahman and Ahmad, 2019). This implies that developing countries incur significant costs to purchase machinery and construct fundamental physical infrastructure to expand production, while industrialized nations invest their costs in resource-intensive assets (Södersten et al., 2017; Prakash and Sethi, 2023). As it promotes investment in assets and technological innovations, it also encourages local firms to grow and increase production (Ali, 2015).

Somalia, once plagued by civil wars and a lack of a functioning government, is now emerging as a developing country experiencing economic growth. The absence of a functional government had impeded economic development, particularly in terms of maintaining infrastructure and establishing regulatory and governance frameworks. This challenge prompted the nation to address the complex task of rebuilding its sources of public income (Somalia Inter-Ministerial of Public Work, 2018).

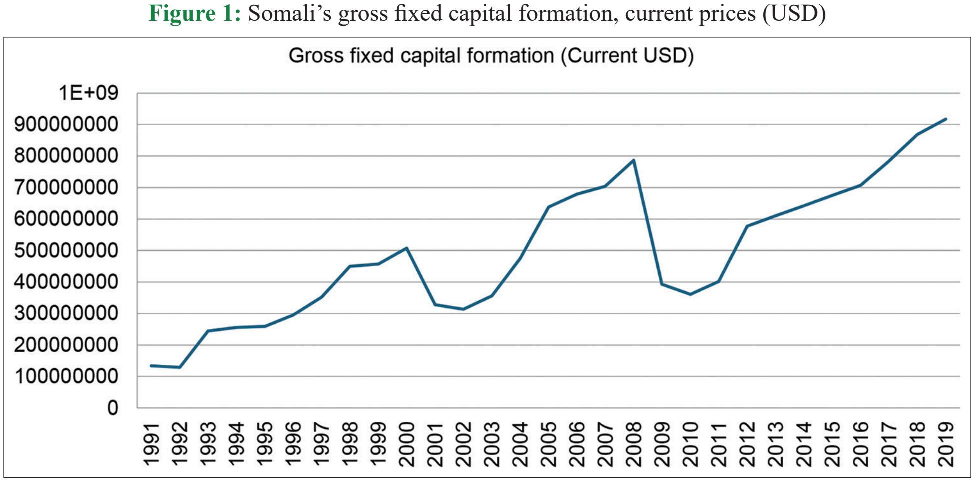
Since the establishment of the federal republic of Somali in 2012, significant changes have occurred. Interested investors, primarily from the Somali diaspora and a handful of foreign institutions, have started to invest in various private sectors such as building hospitals, manufacturing, and information technology. Public infrastructure, including airports, ports, and roads, has also undergone expansion (Benson et al., 2015; Lloyds Bank, 2022). Furthermore, the government has initiated a transportation investment plan, valued at 1.1 billion dollars over 10 years starting in 2016, with the aim of enhancing transport demand assessments. This strategic initiative is expected to attract investment inflows to the country, thereby contributing to sustained economic growth (Daily, 2022).

Considering Figure 1, gross fixed capital formation in the country has steadily grown since 2012, reaching its peak in 2019 at $917 million. Somali GCF increased from $134 million in 1991-$920 million in 2019, with an average annual change of 3.27%.

Even though investments in capital formation assist developing nations in achieving high economic growth, tensions around environmental risks are intensifying (Bukhari et al., 2014; Ahmad et al., 2019; Topcu et al., 2020; Mitić et al., 2020).

Somalia's environmental assets, including forests, land, and sub-soil possessions, perform an important part in the country's economy. Unfortunately, it has been misused for decades without proper public protection. Over 429,000 hectares of trees have vanished, representing a 4.9% reduction in the country's total tree count and resulting in 840,000 tons of CO_2 equivalent emissions (World Bank, 2022). One of the main contributors to this extensive deforestation is cash-generating activities, particularly charcoal burning. A study by Warsame and Sarkodie (2022) revealed that approximately 82% of Somali households' energy consumption relies on charcoal and firewood.

Figure 1: Somali's gross fixed capital formation, current prices (USD)



Source: Author's calculation

Furthermore, charcoal production has evolved into one of the country's primary exports, often referred to as "black gold" (Bakonyi et al., 2006). Each year, more than 4 million plants are chopped down to produce 250,000 tons of charcoal, exported from Somalia to the United Arab Emirates, Yemen, and Saudi Arabia (Bolognesi et al., 2015; UNEP, 2005). A government report highlighted that the country lost almost 150,000 km^2 due to land deforestations between 2000 and 2015, accounting for 28% of its entire geographical region (The Federal Republic of Somalia, 2020).

Without deterioration, the predicted value of Somalia's mineral resources would be an impressive US$222.3 billion (World Bank, 2020). Emphasizing environmentally friendly control and ensuring the agricultural profitability of the territory are decisive for the well-being of future generations.

In summary, the pursuit of economic development, notably through Gross Fixed Capital Formation (GFCF), remains a pivotal aspect of Somalia's policy landscape. However, the concurrent rise in climate change resulting from intensified industrial activities has yet to be adequately explored within the Somali context. This empirical gap underscores the pressing need for a systematic investigation into the intricate dynamics governing the nexus relating GCF and carbon emissions in Somalia. The present research tries to give novel understandings into the connection between macroeconomic and environmental issues in Somalia. Its primary objective is to generate practical policy recommendations for fostering sustainable environmental and economic development in the country. More specifically, the research delves into the nexus among GCF and CO_2 emissions in Somalia.

The remaining work is prepared as follows: Section 2 provides a summary of relevant literature, Section 3 describes the methodology and data, Section 4 reports the results of the study, and Section 5 concludes the paper with policies and recommendations.

2. LITERATURE REVIEW

Many theories of economic growth emphasize the crucial role that domestic investment plays as one of the mechanisms for growth (Keller and Yeaple, 2009). Various economic theories describe how the influence of capital accumulation leads to a stable pace of economic growth, such as the neoclassical growth theory and the Keynesian idea of growth (the Harrod-Domar model). Numerous empirical studies were considered when examining this theoretical perspective. Bond et al. (2010) examined capital accumulation and growth in 75 states spanning from 1960 up to 2000. The study found positive associations among investment as a proportion of GDP and the long-term growth rate of GDP. Ramirez and Mordecki (2014) examined investment, growth, and employment in Uruguay using VECM. The results show a long-run association between investment and economic growth.

However, the literature is still debating the relationship concerning GCF and Carbon dioxide emissions, with limited research on how environmental quality relates to capital formation. According to Södersten et al. (2018), the variability in the global carbon footprint across nations is more explicit compared to the variation in the share of GCF within the GDP. Typically, nations in the initial phases of economic progression allocate a higher proportion of their resources toward rigorous assets such as equipment and infrastructure construction. Conversely, affluent nations tend to fund less in resource-intensive assets, focusing more on technology, programs, and services.

Other researchers, such as Satrovic et al. (2020), examined the association among CO_2 emissions and GCF in Kuwait and Turkey, covering 1971-2014. The results indicated an association between investment inflow and the amount of CO_2 emissions. Furthermore, Rahman and Ahmed (2019) explored the link relating GCF and Carbon dioxide emissions in Pakistan, covering time series data from 1980 to 2016. The authors found that GCF shocks have varying influences on CO_2 emissions in both long-run and short-run conditions.

Baek (2016) conducted a study of five ASEAN nations to demonstrate a notable association between increasing levels GCF and FDI. Spanning the time from 1981 to 2010, the study utilized the pooled mean group (PMG) method to scrutinize the long-term relationship between carbon dioxide emissions, FDI, energy consumption, and growth levels. The findings concluded that GCF had a substantial and adverse environmental impact in each of the five Asian nations examined, primarily attributable to the surge in emissions associated with GCF.

Bekhet et al. (2017) studied the linkage between financial development, economic growth, energy consumption, CO_2 emissions, and GFC formation spanning from 1970 up to 2013. They indicated that gross fixed formation has a direct correlation with CO_2 emissions in Malaysia.

Mitić et al. (2020) conducted an analysis investigating the association among Carbon dioxide emissions, industrial services, and gross fixed capital formation in Balkan nations during the period from 1996 to 2017. Employing panel tests for cointegration and causality, the study revealed robust cointegration among variables, indicative of enduring connections with carbon dioxide emissions. Furthermore, the findings unveiled a unidirectional causality, underscoring a significant influence from GCF to CO_2 emissions.

Mujtaba et al. (2022) investigated the linear and non-linear effect of economic growth, capital formation, and renewable energy consumption on the environment in OECD nations, spanning data from 1970 to 2016. They concluded that GCF dampens ecological value in the sampled countries under study.

Gao et al. (2020) studied carbon dioxide emissions in fixed capital formation and its spatial distribution in China. They found that gross fixed capital formation deteriorates environmental cleanliness in China. Additionally, the conclusion highlighted a significant surge in fixed capital formation-linked CO_2 emissions, with the numbers escalating from 2436 million tons (Mt) in 2007 to 4820 Mt in 2012. This upward trend continued, registering a modest increase to 5089 Mt by 2017.

Despite certain studies suggesting a positive link among GCF and CO_2 emissions, others have found evidence to the contrary. A study by Adebayo and Beton Kalmaz (2021) examined the elements of carbon dioxide emissions in Egypt and showed that there is no substantial relationship among capital formation and carbon dioxide emissions in Egypt.

Bukhari et al. (2014) investigated the effect of FDI and capital formation on carbon dioxide emissions in Pakistan, spanning data from 1974 to 2010. The findings demonstrated that GCF can reinstate environmental excellence by implementing environmentally friendly manufacturing techniques. Nathaniel and Adeleye (2021) utilized panel-corrected standard errors spanning from 1992 up to 2016. The authors found that there is no substantial relationship among GCF and carbon dioxide emissions in 44 African countries.

Prakash and Sethi (2023) examined the connection among fixed capital formation and CO_2 emissions in the case of India. They demonstrated that gross fixed capital formation had no significant association with CO_2 emissions before liberalization. However, the results also indicated a positive and significant association concerning GCF and CO_2 in the post-liberalization period.

Despite the wealth of research, critical gaps persist. A notable absence in the literature revolves around the long-term environmental consequences of specific investments in gross fixed capital formation. This identified gap suggests the need for research to delve deeper into the nuanced impacts of various capital formations on CO_2 emissions, with a particular emphasis on Somalia.

3. THE METHODOLOGY OF THE STUDY

3.1. Data

Annual quantitative data for Somalia from 1991 up to 2019 have been utilized in this research. This study collected the data from the Organization of Islamic Cooperation (OIC-SESRIC) and the World Development basis. Table 1 details the characteristics of the variables, including their definitions, base, and symbols, which were selected for examination. The metric for CO_2 emissions per ton was used as the dependent variable in this study, while GCF, GDP, GDP^2, RE, and URB were used as explanatory indicators.

3.2. Econometric Methodology

3.2.1. Unit root test

The initial assessment of time-series data involves determining whether the parameters are stationary, as the presence of unit root problems can lead to spurious regression. To assess stationarity, the study conducted a regression analysis to verify that all of the parameters exhibited unit root problems. This step is crucial because variables with unit root or non-stationary characteristics can significantly impact the accuracy of results interpretation. Failure to address non-stationarity may lead to incorrect inferences (Engle and Granger, 1987; Nelson and Plosser, 1982).

This study utilized the most popular tests for assessing the order of integration, namely the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. These techniques were utilized to examine the presence of unit roots. The null hypothesis for each test posits the presence of a unit root, whereas the alternative hypothesis confirms the lack of a unit root issue.

The coming equation shows the basic structure of ADF analysis:

$$\Delta Y_t = \lambda_0 + \lambda_1 + \delta Y_{t-1} + \Delta Y_{t-j} + \varepsilon_t \quad (1)$$

ΔY_t symbolizes a related variable; λ_0, λ_1 refers the slope of the variables; j denotes lag order for dickey fuller improvement; ε_t demonstrates that it is serially inconsistent.

On the other hand, For PP, the equation is shown below.

$$\Delta Y_t = \Phi + \rho y_{t-1} + \varepsilon_t \quad (2)$$

Additionally, Akaike and Hannan-Quinn information criteria are used as the optimal lag selection criteria since the data being examined are from small sample sizes.

3.2.2. Autoregressive distributed lag (ARDL) Co-integration bound test

The subsequent stage involves determining predetermined results and integration levels to assess the co-integration link among the variables under examination. The Wald F-test is deployed to evaluate the null hypothesis, suggesting no cointegration between the variables under study, in contrast to the alternative hypothesis indicating cointegration among the explanatory and dependent variables in the study.

Furthermore, the F-test is employed to determine whether to accept or refused the null hypothesis. It is compared against critical lower bound levels, denoted as I (0), and upper bound limits, denoted as I (1). If the determined F-test surpasses the upper bound limit, the study rejects the null hypothesis, indicating the presence of cointegration among the variables.

ARDL bound technique is deemed suitable for this study (Pesaran et al., 2001). This surpasses the limit imposed by the co-integration steps (Engle and Granger, 1987; Johansen and Juselius, 1990), which need variables to be combined either at order I (0) or I (1).

Table 1: Details of the variable

Variables	Symbol	explanation	Source
CO_2 Emissions	LCO_2	CO_2 emissions (metric tons)	WDI
Gross fixed capital formation	LGCF	Gross fixed capital formation (current US$)	SESRIC
Gross domestic product	LGDP	GDP (current US$)	SESRIC
The square value of gross domestic product	LGDP.sq	GDP (current US$) * GDP (current US$)	
Renewable energy consumption	LRE	RE (% of total final energy consumption)	WDI
Urbanization	LURB	Urban population	WDI

3.2.3. ARDL long-run and short-run estimation

To achieve the aim of the study, this research commissioned the ARDL Bound testing approach as proposed by Pesaran et al. (2001). Furthermore, the ARDL method provides several advantages over standard cointegration tests. Firstly, it is applicable irrespective of whether the parameters are I(0), I(1), or mixed (Pesaran et al., 2001). Secondly, this approach proves to be particularly beneficial for small sample sizes when compared to older classical tests. Thirdly, ARDL allows for the sequential regression of long-run and short-run equations, a feature not present in earlier techniques.

To assess the influence of GFC, GDP, GDP2, RE, and URB on CO_2 emissions, a conceptual structure is created by referring to the publication of Shahbaz and Sinha, (2019); Rahman and Ahmad, (2019). The following equation was applied to consider the linear connection among the variables.

$$CO_{2t} = \lambda_0 + \lambda_1 GFCF_t + \lambda_1 GDP_t + \lambda_2 GDP_t^2 + \lambda_3 RE_t + \lambda_4 URB_t + \varepsilon_t \quad (3)$$

Using the logarithm of variables is a common practice in econometrics to address issues such as non-normality and heteroscedasticity. By taking the logarithm, skewed distributions may become more symmetric, and the transformation can stabilize the variance of the data. This approach is often applied to achieve the assumptions of linear regression models, which assume normality and homoscedasticity of residuals. It's essential to note that the interpretation of coefficients in a logarithmic model is in percentage terms, and it may help linearize relationships that exhibit exponential growth or decay.

$$LCO_{2t} = \lambda_0 + \lambda_1 LGFCF_t + \lambda_1 LGDP_t + \lambda_2 LGDP_t^2 + \lambda_3 LRE_t + \lambda_4 LURB_t + \varepsilon_t \quad (4)$$

Where LCO_{2t} denotes CO_2 metric per ton at t in logarithmic notation form, $LGFCF_t$ represents log Gross fixed capital formation, $LGDP_t$ is log GDP, $LGDP_t^2$ is log of the square term of gross domestic product, LRE_t demonstrates the logarithmic form of renewable energy consumption, and $LURB_t$ stands for the log of urban population. λ_0 symbolizes the Constant term, while the slopes of the parameters are indicated by λ_1-λ_4, and the residual term is symbolized by ε_t. The study utilized ARDL test to evaluate the long-run and short-run cointegration between the variables mentioned above and can expressed as follows:

$$\Delta LCO_{2t} = \alpha_0 + \phi_1 LCO_{2t-1} + \phi_2 LGCF_{t-1} + \phi_3 LGDP_{t-1} + \phi_4 LGDP_{t-1}^2 + \phi_5 RE_{t-1} + \phi_6 URB_{t-1} + \sum_{m=1}^{z} \varphi_1 \Delta LCO_{2t-m} + \sum_{m=0}^{j} \varphi_2 \Delta LGCF_{t-m} + \sum_{m=0}^{j} \varphi_3 \Delta LGDP_{t-m} + \sum_{m=0}^{j} \varphi_4 \Delta LGDP_{t-m}^2 + \sum_{m=0}^{j} \varphi_5 \Delta LRE_{t-m} + \sum_{m=0}^{j} \varphi_6 \Delta LURB_{t-m} + U_t \quad (5)$$

α_0 is the constant term. ϕ_1-ϕ_6 represents the regression coefficients of the long-term explanatory variables. t-1 denotes the lagged time variable. φ_1-φ_6 verify the slope of the short-run parameters. Δ is the first difference mechinist. z and j indicate the selected optimal lags for dependent and explanatory variables. U_t is the stochastic error term. This structure suggests that the model incorporates both long-run relationships (captured by the ϕcoefficients) and short-run dynamics (captured by the φ coefficients). Lagged variables are included, and the first difference operator is applied to certain variables.

Indeed, the ARDL bound method involves testing hypotheses related to the long-run association between parameters. The primary objective is to determine whether there is a persistent connection between the variables under study. This testing typically revolves around the coefficients of the covered levels of the variables. In the context of the ARDL model, the hypothesis testing often focuses on the presence of cointegration, which suggests a long-run association with variables. The null hypothesis usually states that there is no cointegration (no long-run association), and the alternative hypothesis suggests the presence of cointegration.

Both of the hypothesis is derived as below:

H_0: $\phi_1 = \phi_2 = \phi_3 = \phi_4 = \phi_5 = \phi_6$

H_1: $\phi 1 \neq \phi 2 \neq \phi 3 \neq \phi 4 \neq \phi 5 \neq \phi 6$

This technique verifies the estimated F-bound cointegration in comparison to the summarized information generated by the low and high restrictions. If the F-bound statistic exceeds the upper bound restriction, the null hypothesis (H_0) is refused, revealed that the parameters are likely connected or cointegrated (Banerjee et al., 1998).

3.2.4. Robust check of FMOLS and DOLS

To validate the accuracy of the outcomes, the research utilized both the fully modified ordinary least squares (FMOLS) and the dynamic ordinary least squares (DOLS) methods. Both methodologies provide extent of statistical implication and have the capability to address challenges associated with ordinary least squares (OLS), such as limited sample bias, serial correlation, and endogeneity problems. A significant advantage of both methods is their ability to accommodate different orders of integration in cointegration structures (Masih and Masih, 1996; Stock and Watson, 1993). By considering the characteristics of these estimators, their outcomes serve as a strength test for the ARDL long-run outcomes.

3.2.5. Pairwise granger causality tests

To assess the trend of causation, the study conducted pairwise Granger causality tests to identify the fundamental connections among the parameters. The principle of Granger causality can be applied to establish causation, irrespective of whether the series is long run cointegrated or if any form of interconnection exists among the variables. A major advantage of the Granger causality test is its ability to examine numerous lags at once.

4. RESULTS OF THE STUDY

4.1. Descriptive Statistics and Data Visualization

The variable CO_2, representing carbon dioxide levels, has a mean of 0.0612, with a minimum value of 0.043 and a maximum value of 0.106 (Table 2). Standard deviation (0.018) suggests relatively low variability. However, high kurtosis (3.616) and the positive skewness (1.319) indicate a distribution with a longer right tail and more peaked than a normal distribution. The Jarque-Bera test for normality returns a minimal value of 0.012, hinting at potential deviation from a normal distribution.

GCF demonstrates a mean of 4.931, ranging from 1.291 to 9.171. The standard deviation (2.171) indicates moderate variability. The skewness (0.195) suggests a slightly right-skewed distribution, while the kurtosis (2.033) reflects a distribution with heavier tails. The Jarque-Bera test value (0.518) indicates a relatively normal distribution.

The gross domestic product (GDP) variable has a mean of 2.511 billion, a minimum of 7.091 million, and a maximum of 6.491 billion. The standard deviation (1.801) indicates moderate variability. The positive skewness (1.055) and kurtosis (2.557) suggest a distribution with a longer right tail and moderate peakedness. The Jarque-Bera test value (5.619) is higher, indicating potential non-normality.

Renewable energy (RE) showcases a mean of 92.779, ranging from 87.73 to 95.03. The standard deviation (1.911) suggests moderate variability. The negative skewness (−1.099) and kurtosis (3.439) indicate a left-skewed distribution with heavy tails. The Jarque-Bera test value (0.045) suggests a departure from normality.

The variable Urbanization, representing urban population, displays a mean of 4 million, with a minimum of 1.95 million and a maximum of 7.280 million. the standard deviation 1.615 million implies considerable variability. The positive skewness (0.491704) and kurtosis (2.067) suggest a distribution with longer right tail and moderate peakedness. The Jarque-Bera test value (0.329) indicates relative normality.

These descriptive statistics provide a comprehensive summary of the central tendencies, variabilities, and distributions of the key variables. The interpretation of skewness, kurtosis, and Jarque-Bera tests offers valuable insights into the nature of the datasets.

4.2. Unit Root Test

Checking for the persistence of a unit root is an essential first step to prevent the pitfalls of spurious regression in time series data. The inference of PP and ADF analyses are given in Table 3. As the ARDL model admits the stationarity of time series data at I (0) or I (1), the ADF confirms that variables exhibit a unit root problem at the level, except for log (CO_2) and log (URB). Similarly, the outcome of the PP test also appears that variables exhibit a unit root problem at the level, except for log (RE) and log (URB).

Nevertheless, none of the series showed a unit root complication at the first difference I (1), which means the parameters attain stationarity afterward the first difference I (1). This can be observed by comparing the test statistics' pragmatic values of ADF and PP with the critical values at the 10%, 5%, and 1% levels of significance. Hence, the ARDL test can be employed.

4.3. ARDL Bounds co Integration Test

Table 4 indicates the ARDL bounds cointegration test to explore the existence of a longer-term connection among CO_2 and other explanatory variables. The findings, however, demonstrate that the F-statistic (13.489) outstrip the upper bound critical value (4.68) at 1% and (3.79) at a 5% significance level. Therefore, the

Data visualization

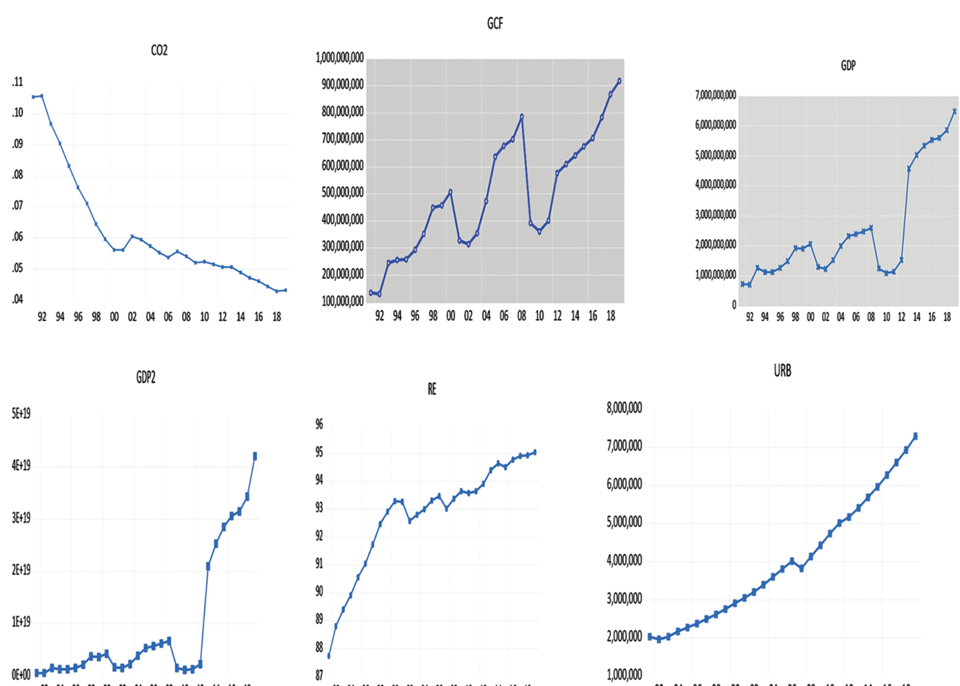


Table 2: Summary of statistics

Variables	Mean	Max	Min	Std.Dev	Skew	Kurt	J. B
CO_2	0.0612	0.106	0.043	0.018	1.319	3.616	0.012
GCF	4.931	9.171	1.291	2.171	0.195	2.033	0.518
GDP	2.511	6.491	7.091	1.801	1.055	2.557	5.619
GDP2	9.432	4.212	5.032	1.262	1.369	3.302	3.43
RE	92.779	95.03	87.73	1.911	−1.099	3.439	0.045
URB	3999754	7280121	1951519	1615383	0.491704	2.067	0.329

existence of a longer-term association is affirmed in the model. In conclusion, the study rejects the null hypothesis.

4.4. Sensitivity Outcomes

The Table 5 presents the diagnostic test of the approximated ARDL model, and the results confirm the clearances all diagnostic checks, including the Jarque-Bera test, Heteroskedasticity test, serial correlation LMS, and ARCH Test. Hence, all diagnostic test values are beyond P-value at a 5% significance level.

Furthermore, the study conducted CUSUM and CUSUMQ tests to confirm the steadiness of the model (Figures 2 and 3). The figures indicate that the blue curve remains within the borderline curves, confirming the robustness of the study.

4.5. Estimation of ARDL with Robust Check Results

Table 6 presents the long-run and short-run outcome among GCF, urbanization, GDP, GDP^2, RE, and CO_2 emissions. The outcomes reveal a negative and significant long-term connection between GCF and CO_2 emission in Somalia. Specifically, a 1% raises in GCF primes to a 0.105% fall in carbon dioxide emission in the long run. This conclusion aligns with the findings of (Satrovic et al., 2020) and (Prakash and Sethi, 2023), who concluded that GCF has a negative change on CO_2 emission.

Moreover, the GDP and GDP^2 variables were employed to examine the EKC in the country. Despite the positive coefficient for GDP and the negative coefficient for GDP2, both of these coefficients were statistically insignificant. Consequently, this study did not succeed in confirming the occurrence of an EKC in Somalia.

Conversely, renewable energy mitigates CO_2 emissions in the long-term. A 1% change in energy consumption drops carbon dioxide emissions by 11.977% in the long term. This mark aligns with the empirical conclusions of (Rej and Nag, 2022) and (Pattak et al., 2023) in India and Italy, respectively. Furthermore, urbanization promotes carbon dioxide emissions in the long run, where a change in urbanization marks in a 0.142% increase in CO_2 emissions. This outcome aligns with the results of studies accompanied by Dilanchiev et al. (2023) in BSEC member states.

After employing ARDL as our primary technique, we re-examined the results presented in Table 6. To ensure the strength of our conclusions, the research decides to conduct additional checks FMOLS and DOLS. The result of these robustness checks are providing in Table 7.

In the FMOLS model findings, a 1% increase in LGCF, LGDP2, LRE, and LURB leads to a decline of 0.111%, 0.053%, 11.508%,

Table 3: Unit root tests

Variables	ADF	ΔADF	PP	ΔPP
LCO_2	−3.295*	−3.812**	−1.783	−3.812**
LGCF	−2.999	−4.644***	−2.618	−4.664***
LGDP	−2.759	−4.166**	−2.336	−4.166**
LGDP2	−2.708	−4.162**	−2.307	−4.162**
LRE	−2.508	−4.010**	−3.591**	−3.993**
LURB	−5.400***	−6.434***	−6.110***	−10.261***

***, **, and *stand for significance levels at 1%, 5%, and 10% for PP and ADF tests, respectively

Table 4: F-co integration results

Test statistics	Value	K	H_0=No levels relationship	H_1=relationship exists
F-statistics	13.489	5		
Critical bounds				
Significant level	I (0)	I (1)		
10%	2.26	3.35		
5%	2.62	3.79		
2.50%	2.96	4.18		
1%	3.41	4.68		

Table 5: Sensitivity outcomes

Residual diagnostics	F-Stat.	P-values
Jacque-Bera	0.169	0.918
Heteroskedasticity test: Breusch-Pagan-Godfrey	0.546	0.844
ARCH test	0.970	0.334
Breusch-Godfrey serial correlation LM Test:	1.282	0.308

Table 6: Long-run and short-run ARDL bound test results

Long-run estimates		
Variables	Coeff	S. E
LGCF	−0.105	−2.595**
LGDP	1.752	−1.273
LGDP2	−0.04	−1.295
LRE	−11.977	−15.165***
LURB	0.142	2.195 **
Short-run Estimates		
ΔLCO_{2t-1}	0.249	2.153**
ΔLGCF	−0.063	−3.190***
ΔLGDP	−0.494	−0.817
ΔLGDP2	0.012	−0.913
ΔLRE	−8.473	−15.080***
ΔLURB	−0.136	−1.569
C	25.578	2.711**
ECM_{t-1}	−0.750	−10.306***
R^2	0.998	
Adj.R^2	0.997	
F-stat	1028.925***	

Asterisk***, **, and* denote statistical significance levels at 1%, 5%, and 10%, respectively

Table 7: Robust check

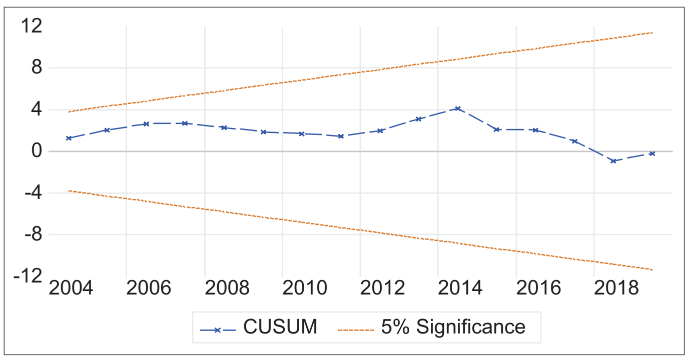
Variables	FMOLS model		DOLS model	
	Coefficient	T-stat.	Coefficient	T-stat.
LGCF	−0.111***	−2.844	−0.151***	−4.685
LGDP	2.382*	1.978	4.245***	5.005
LGDP2	−0.053*	−1.944	−0.096***	−4.957
LRE	−11.508***	−14.202	−13.383***	−6.157
LURB	−0.021	0.638	0.095**	3.732
C	25.458**		12.653	
R^2	0.993		0.997	
S.E of Regression	0.021		0.006	

*, **, and ***, demonstrate 10%, 5%, and 1% significant levels, respectively

Table 8: Granger causality results

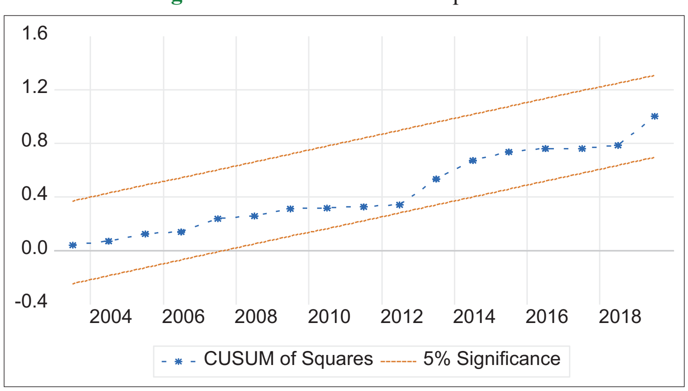
Null Hypothesis	Observations	F-Statistic	Prob.
LGCF → LCO_2	28	4.35695	0.0472
LCO_2 → LGCF	28	1.49139	0.2334
LGDP → LCO_2	28	4.49825	0.0440
LCO_2 → LGDP	28	0.42816	0.5189
LGDP2 → LCO_2	28	4.38827	0.0465
LCO_2 → LGDP2	28	0.42701	0.5194
LRE → LCO_2	28	12.1818	0.0018
LCO_2 → LRE	28	0.21010	0.6506
LURB → LCO_2	28	0.15474	0.6974
LCO_2 → LURB	28	1.83673	0.1875

Figure 2: Plot of CUSUM test



Source: Author's computation

Figure 3: Plot of CUSUM of square test



Source: Author's computation

and 0.021%, respectively, in CO_2 emissions. However, only the value for LURB is not statistically significant, while the others are significant, supporting the results of ARDL as indicated in Table 6. In addition, an increase in LGDP primes to a surge of 2.382% in CO_2 emissions, and this value is significant, aligning with the result of ARDL.

In the DOLS model, a 1% surge in LGCF, LGDP2, and LRE to a decline of 0.151%, 0.096%, and 13.383%, respectively, in CO_2 emissions. All these values are significant, supporting the outcomes of ARDL in Table 6 in terms of significance. Additionally, an increase in LGDP and LURB results in a 4.245% and 0.095% rise in CO_2 emissions, respectively. Both these coefficients are significant, mirroring the outcomes of the ARDL model.

The robust checks of FMOLS and DOLS indicate the presence of an environmental kuznets curve in both models. This is observed as GDP and the GDP^2 exhibit positive and negative signs, respectively, and the study is significant at 10% and 1%. These results fulfill the requirements needed for verification indicating the existence of an EKC association among gross domestic product and carbon dioxide emissions in Somalia.

4.6. Granger Causality Outcome

In Table 8 of the study, Granger causality tests were conducted for parameter pairs, including GCF_LCO_2, GDP_LCO_2, GDP2_LCO_2, LRE_LCO_2, and LURB_LCO_2. The influence of Granger causality tests is contingent upon the number of lags, leading the study to employ criteria to determine the most suitable one. Specifically, criteria like the HQ criterion and SC criterion were considered. Nevertheless, in this research, the Hannan-Quinn criterion was adopted to select the desired lags.

The study identified a unidirectional causality among GCF and CO_2 at a 5% significance level. Additionally, the research demonstrated that gross domestic product can Granger cause carbon dioxide emissions at 5% significant level. Renewable energy was found to Granger cause LCO_2 at a 1% significance level. In contrast, the study discovered no directional association among (LURB) and carbon dioxide emissions (LCO_2), with the probability value being deemed insignificant.

5. CONCLUSION

Academics and environmental scholars commonly attribute the principal causes of CO_2 emissions to the utilization of energy, economic expansion, and FDI. These elements also substantially contribute to environmental concerns. In this study, we comprehensively examined the influence among GCF and environmental quality in Somalia, utilizing Autoregressive Distributed Lag for statistical analysis. We confirmed our findings robustly through Fully Modified and Dynamic Ordinary Least Square models, covering the period from 1991 to 2019.

The research employs a rigorous methodological approach, encompassing a comprehensive set of pre-estimation tests such as unit root tests, cointegration tests, Granger causality tests, and optimization of lag criteria. These diagnostic procedures underscore the meticulousness of the empirical inquiry. Unit root tests ensure variable stationarity, enhancing the robustness of time series data within the econometric framework. The ADF test in the study revealed that parameters exhibit a unit root problem at the level, except for the logarithmic transformation of carbon dioxide emissions and logarithmic urbanization. Similarly, the findings of the PP test reveal that all parameters display a unit root problem at the level, except for log (RE) and log (URB).

Concurrently, co-integration tests unveil long-term equilibrium relationships, shedding light on potential interdependencies within explanatory variables and carbon dioxide emissions. Granger causality tests contribute by discerning temporal precedence and causal linkages between variables, enriching the understanding of their interplay. The study also critically addresses lag selection, aiming to minimize biases in parameter estimation and ensure an accurate representation of underlying dynamics. This consolidation of methodological components not only reinforces the reliability of subsequent estimation results but also signifies a commitment to nuanced and rigorous analytical procedures.

Beyond contributing to the scholarly discourse on GCF and CO_2 emissions in the case of Somalia, the study's investigations concluded that coefficients derived from empirical analysis indicate GCF exerts no significant impact on CO_2 emissions within the context of Somalia.

These findings highlight the absence of a discernible relationship between GCF and the levels of CO_2 emission in Somalia. This outcome underscores the complex and multifaceted nature of factors contributing to carbon emissions in Somalia, where GCF does not emerge as a noticeably influential determinant. Consequently, these results prompt further inquiry into the nuanced dynamics and variables contributing to the environmental impact of economic activities in the specific socio-economic and environmental context of Somalia. This empirical insight contributes to the ongoing scholarly converse on the interplay between economic development indicators and environmental sustainability. It provides valuable considerations for researchers involved in sustainable development initiatives within Somalia.

5.1. Policy Recommendations

The study recommends that policymakers adopt a comprehensive environmental policy framework that considers various contributing factors beyond GCF. Initiatives such as the diversification of energy sources, technology transfer, promotion of sustainable practices, and integration of climate resilience are recommended to address the multifaceted nature of environmental challenges. Furthermore, the study advocates for robust monitoring mechanisms, public awareness campaigns, and international collaboration to enhance the effectiveness of environmental policies. The recommendations highlight the importance of flexibility in policy design, allowing for adaptation based on evolving economic and environmental conditions.

Overall, these insights contribute significantly to the ongoing debate on equalizing economic growth and environmental sustainability in the unique socio-economic landscape of Somalia. Policymakers and researchers are encouraged to consider these nuanced findings when formulating strategies for a sustainable and resilient future in the country.

5.2. Limitations and Future Research

This study scrutinizes the impact between GCF and carbon dioxide emissions in Somalia, focusing on the period from 1991 to 2019. However, the temporal scope poses a limitation, potentially missing recent contextual shifts. While the complexity of econometric models enhances depth, it introduces challenges of potential overfitting and interpretability. The exclusive emphasis on GCF may overlook latent variables impacting the environmental dynamic, and data constraints, including incomplete or unavailable data, hinder comprehensive analysis. Additionally, the linear assumption in the GCF-carbon emissions relationship might oversimplify nuanced dynamics, and external factors such as geopolitical events remain elusive, complicating the isolation of GCF's impact.

Future research could explore non-linear models, include a more extensive array of variables, and conduct temporal and spatial analyses for nuanced patterns. Policy impact assessments and dynamic modeling could evaluate the efficacy of existing policies and provide a more nuanced representation of the interplay between GCF and carbon dioxide emissions. Comparative studies with other nations facing similar challenges offer potential insights. Acknowledging these limitations, this study contributes to Somalia's economic development and environmental discourse, emphasizing the need for nuanced and evolving empirical inquiry to inform evidence-based policies.

REFRENCES

Abbas, Q., Nurunnabi, M., Alfakhri, Y., Khan, W., Hussain, A., Iqbal, W. (2020), The role of fixed capital formation, renewable and non-renewable energy in economic growth and carbon emission: A case study of belt and road initiative project. Environmental Science and Pollution Research, 27, 45476-45486.

Adebayo, T.S., Beton Kalmaz, D. (2021), Determinants of CO_2 emissions: Empirical evidence from Egypt. Environmental and Ecological Statistics, 28, 239-262.

Ahmad, M., Zhao, Z.Y., Rehman, A., Shahzad, M., Li, H. (2019), Revealing long-and short-run empirical interactions among foreign direct investment, renewable power generation, and CO_2 emissions in China. Environmental Science and Pollution Research, 26, 22220-22245.

Akpan, U.F., Akpan, G.E. (2012), The contribution of energy consumption to climate change: A feasible policy direction. International Journal of Energy Economics and Policy, 2(1), 21-33.

Alam, M.M., Murad, M.W., Noman, A.H.M., Ozturk, I. (2016), Relationships among carbon emissions, economic growth, energy consumption and population growth: Testing Environmental Kuznets Curve hypothesis for Brazil, China, India, and Indonesia. Ecological Indicators, 70, 466-479.

Ali, G.U.L.Z.A.R. (2015), Gross fixed capital formation and economic growth of Pakistan. Journal of Research in Humanities, Arts and Literature Applied, 1(2), 21-30.

Asiedu, B.A. (2021), Do international investment contribute to environmental pollution? Evidence from 20 African countries. Environmental Science and Pollution Research, 28, 41627-41637.

Baek, J. (2016), A new look at the FDI-income-energy-environment nexus: Dynamic panel data analysis of ASEAN. Energy Policy, 91, 22-27.

Bakonyi, J., Abdullahi, A., De l'Ouest, A. (2006), Somalia-no central government, but still functioning. In: Agriculture and Rural Development. Kenya: GTZ International Services. p36-38.

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

Bekhet, H.A., Yasmin, T., Al-Smadi, R.W. (2017), Dynamic linkages among financial development, economic growth, energy consumption, CO_2 emissions and gross fixed capital formation patterns in Malaysia. International Journal of Business and Globalisation, 18(4), 493-523.

Benson, J., Heger, L.L., Sorensen, L.C., Wise, A.E. (2015), Somali Diaspora Investment Survey Report. Colorado: One Earth Future Foundation.

Bharti, N., Yang, L. (2021), Human Capital Accumulation in China and India in the 20th Century. World Inequality Conference.

Boamah, V., Tang, D., Zhang, Q., Zhang, J. (2023), Do FDI inflows into African countries impact their CO_2 emission levels? Sustainability, 15(4), 3131.

Bolognesi, M., Vrieling, A., Rembold, F., Gadain, H. (2015), Rapid mapping and impact estimation of illegal charcoal production in southern Somalia based on WorldView-1 imagery. Energy for Sustainable Development, 25, 40-49.

Bond, S., Leblebicioğlu, A., Schiantarelli, F. (2010), Capital accumulation and growth: A new look at the empirical evidence. Journal of Applied Econometrics, 25(7), 1073-1099.

Bukhari, N., Shahzadi, K., Ahmad, M.S. (2014), Consequence of FDI on CO_2 emissions in case of Pakistan. Middle East Journal of Scientific Research, 20(9), 1183-1189.

Daily, S. (2022), What is Driving Somalia's Foreign Investment Push? Available from: https://www.dailysabah.com/opinion/op-ed/what-is-driving-somalias-foreign-investment-push

Dasgupta, S., Laplante, B., Wang, H., Wheeler, D. (2002), Confronting the environmental Kuznets curve. Journal of Economic Perspectives, 16(1), 147-168.

Demena, B.A., Afesorgbor, S.K. (2020), The effect of FDI on environmental emissions: Evidence from a meta-analysis. Energy Policy, 138, 111192.

Dilanchiev, A., Nuta, F., Khan, I., & Khan, H. (2023). Urbanization, renewable energy production, and carbon dioxide emission in BSEC member states: implications for climate change mitigation and energy markets. Environmental Science and Pollution Research, 30(25), 67338-67350.

Dinda, S. (2004), Environmental Kuznets curve hypothesis: A survey. Ecological Economics, 49(4), 431-455.

Engle, R.F., Granger, C.W. (1987), Co-integration and error correction: Representation, estimation, and testing. Econometrica: Journal of the Econometric Society, 55, 251-276.

Esso, L.J., Keho, Y. (2016), Energy consumption, economic growth and carbon emissions: Cointegration and causality evidence from selected African countries. Energy, 114, 492-497.

Gao, Z., Geng, Y., Wu, R., Zhang, X., Pan, H., Jiang, H. (2020), China's CO_2 emissions embodied in fixed capital formation and its spatial distribution. Environmental Science and Pollution Research, 27, 19970-19990.

Johansen, S., Juselius, K. (1990), Maximum likelihood estimation and inference on cointegration-with appucations to the demand for money. Oxford Bulletin of Economics and Statistics, 52(2), 169-210.

Keller, W., Yeaple, S.R. (2009), Multinational enterprises, international trade, and productivity growth: Firm-level evidence from the United States. The Review of Economics and Statistics, 91(4), 821-831.

Kivyiro, P., Arminen, H. (2014), Carbon dioxide emissions, energy consumption, economic growth, and foreign direct investment: Causality analysis for Sub-Saharan Africa. Energy, 74, 595-606.

Kusmadi, S. (1997), The Measurement of Gross Domestic Fixed Capital Formation in Indonesia. Jakarta: Central Bureau of Statistics.

Kuznets, S. (1955), Economic growth and income inequality. American Economic Review, 45, 1-28.

Lloyds Bank. (2022), Investing in Somalia-International Trade Portal International Trade Portal. Available from: https://www.lloydsbanktrade.com/en/market-potential/somalia/investing

MacDermott, R.J., Basuchoudhary, A., Beng, J. (2019), Trade, trade agreements, and the environment. In: Encyclopedia of Environmental Health. 2nd ed. Oxford: Elsevier. p107-112.

Masih, R., Masih, A.M. (1996), Stock-Watson dynamic OLS (DOLS) and error-correction modelling approaches to estimating long-and short-run elasticities in a demand function: New evidence and methodological implications from an application to the demand for coal in mainland China. Energy Economics, 18(4), 315-334.

Maune, A., Matanda, E. (2022), The nexus between gross capital formation and economic growth: Evidence from Zimbabwe. The Journal of Accounting and Management, 12(2). Available from: https://dj.univ-danubius.ro/index.php/JAM/article/view/1891

Meng, X., Li, T., Ahmad, M., Qiao, G., Bai, Y. (2022), Capital formation, green innovation, renewable energy consumption and environmental quality: Do environmental regulations matter? International Journal of Environmental Research and Public Health, 19(20), 13562.

Mitić, P., Kostić, A., Petrović, E., Cvetanovic, S. (2020), The relationship between CO_2 emissions, industry, services and gross fixed capital formation in the Balkan countries. Engineering Economics, 31(4), 425-436.

Mujtaba, A., Jena, P.K., Bekun, F.V., Sahu, P.K. (2022), Symmetric and asymmetric impact of economic growth, capital formation, renewable and non-renewable energy consumption on environment in OECD countries. Renewable and Sustainable Energy Reviews, 160, 112300.

Nathaniel, S.P., Adeleye, N. (2021), Environmental preservation amidst carbon emissions, energy consumption, and urbanization in selected African countries: Implication for sustainability. Journal of Cleaner Production, 285, 125409.

Nelson, C.R., Plosser, C.R. (1982), Trends and random walks in macroeconomic time series: Some evidence and implications. Journal of Monetary Economics, 10(2), 139-162.

Pattak, D.C., Tahrim, F., Salehi, M., Voumik, L.C., Akter, S., Ridwan, M., Sadowska, B., Zimon, G. (2023), The driving factors of Italy's CO_2 emissions based on the STIRPAT model: ARDL, FMOLS, DOLS, and CCR approaches. Energies, 16(15), 5845.

Pesaran, M.H., Shin, Y., Smith, R.J. (2001), Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics, 16(3), 289-326.

Prakash, N., Sethi, M. (2023), Relationship between fixed capital formation and carbon emissions: Impact of trade liberalization in India. Cogent Economics and Finance, 11(2), 2245274.

Rafindadi, A.A., Muye, I.M., Kaita, R.A. (2018), The effects of FDI and energy consumption on environmental pollution in predominantly resource-based economies of the GCC. Sustainable Energy Technologies and Assessments, 25, 126-137.

Rahman, Z.U., Ahmad, M. (2019), Modeling the relationship between gross capital formation and CO_2 (a) symmetrically in the case of Pakistan: An empirical analysis through NARDL approach. Environmental Science and Pollution Research, 26, 8111-8124.

Ramirez, L., Mordecki, G. (2014), Investment, Growth and Employment: VECM for Uruguay, Working Papers No, 14-07.

Rej, S., Nag, B. (2022), Investigating the role of capital formation in achieving carbon neutrality in India. Environmental Science and Pollution Research, 29(40), 60472-60490.

Saraç, Ş., Yağlikara, A. (2017), Environmental Kuznets curve: Evidence from BSEC Countries. Ege Academic Review, 17(2), 255-264.

Satrovic, E., Muslija, A., Abul, S.J. (2020), The relationship between CO_2 emissions and gross capital formation in Turkey and Kuwait. The Southeast European Journal of Economics and Business, 15(2), 28-42.

Shahbaz, M., Sinha, A. (2019), Environmental Kuznets curve for CO_2 emissions: A literature survey. Journal of Economic Studies, 46(1), 106-168.

Södersten, C.J., Wood, R., Hertwich, E.G. (2018), Environmental impacts of capital formation. Journal of Industrial Ecology, 22(1), 55-67.

Somalia Inter-Ministerial of Public Work. (2018), Somali National Infrastructure Strategy (SNIS). Available from: https://mpwr.gov.so/wp-content/uploads/2019/03/somali-national-infrastructure-strategy-snis.docx

Soytas, U., Sari, R. (2009), Energy consumption, economic growth, and carbon emissions: Challenges faced by an EU candidate member. Ecological Economics, 68(6), 1667-1675.

Stock, J.H., Watson, M.W. (1993), A simple estimator of cointegrating vectors in higher order integrated systems. Econometrica: Journal of the Econometric Society, 61, 783-820.

The Federal Republic of Somalia. (2020), National Voluntary Land Degradation Neutrality Targets, Directorate of Environment, Office of the Prime Minister. Somalia: The Federal Republic of Somalia.

Topcu, E., Altinoz, B., Aslan, A. (2020), Global evidence from the link between economic growth, natural resources, energy consumption, and gross capital formation. Resources Policy, 66, 101622.

UNEP. (2005), The State of the Environment in Somalia: A Desk Study. Kenya: UNEP.

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.

World Bank. (2020), Somalia Country Environmental Analysis: Diagnostic Study on Trends and Threats for Environmental and Natural Resources Challenges. United States: World Bank.

World Bank. (2022), Somalia Needs Its Trees to Restore Landscapes and Livelihoods. Available from: https://blogs.worldbank.org/africacan/somalia-needs-its-trees-restore-landscapes-and-livelihoods