Original Article

ENERGY & ENVIRONMENT

Energy & Environment
1–21

Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/0958305X221083240
journals.sagepub.com/home/eae
SAGE

Sterling insights into natural resources intensification, ageing population and globalization on environmental status in Mediterranean countries

Bright Akwasi Gyamfi[1], Tomiwa Sunday Adebayo[2], Festus Victor Bekun[3,4] and Mary Oluwatoyin Agboola[5]

Abstract

Along with the increasing aging population (AP) and global interconnectedness in the Mediterranean bloc comes climate change issues faced by the Mediterranean region in its trajectory to energy security and sustainable development. To meet the continuous energy consumption demand while cutting down natural resources extraction and exploitation with a view to minimizing environmental impacts, the policy structure in these countries may require readjustment, which is the motivation for the present study. This study advances a strategic framework for investigating the impact of natural resources rent as well as aging reliance on carbon emissions in the Mediterranean region for the annual frequency data from 1990–2016. Using quantile regression to analyze the highlighted variables, empirical results shows that both income and natural resources rent have an inverted U-Shaped connection with CO_2 emission, which affirms the Environmental Kuznets Curve (EKC) hypothesis. Subsequently, globalization and energy use show a positive relationship with emissions while AP is negatively correlated with emissions. Depending on the outcomes of this analysis, a multi-stage

[1]Economic and Finance Application and Research Center, İstanbul Ticaret University, Istanbul, Turkey
[2]Department of Business Administration, Faculty of Economics and Administrative Science, Cyprus International University, North Cyprus, Turkey
[3]Faculty of Economics Administrative and Social Sciences, Istanbul Gelisim University, Istanbul, Turkey
[4]Department of Economics Security, South Ural State University, 76, Lenin Aven., Chelyabinsk, Russia
[5]College of Business, Finance and Banking Department, Dar Al Uloom University, Riyadh, Saudi Arabia

Corresponding author:
Festus Victor Bekun, Faculty of Economics Administrative and Social Sciences, Istanbul Gelisim University, Istanbul 9053, Turkey & Department of Economic Security South Ural State University, 76, Lenin Aven., Chelyabinsk, 454080, Russia & Faculty of Economics and commerce, The Superior University Lahore, Pakistan.
Email: fbekun@gelisim.edu.tr

Sustainable Development Goal (SDG) framework has been developed and SDG- 7, SDG -13 as well as SDG-8 were examined in this context. While these three SDGs are the main targets of the study, the SDG System has also provided a way to test other SDGs.

Keywords

Income, natural resources rent, globalization, energy use, ageing population, CO_2 emission, EKC and Mediterranean region

Introduction

For the last quarter-century, environmental emissions challenges have been a subject of interest for environmentalists, researchers, economists, and policy makers. Human demand for natural resources exploitation and extraction is exerting pressure on the environment, creating several environmental issues that are not restricted to loss of biodiversity, climate change, environmental emissions, and soil degradation.[1-3] Boundless human utilization of natural resources brings permanent harm to the ecosystem, adversely affecting the long-term social and economic growth goals of the globe.[4] Extreme extraction and use of natural resources as well as increased emissions of waste and pollution are threatening national economies. At this junction, carbon dioxide emissions (CO_2) are causing major environmental issues, including habitat destruction, climate change, and global warming. As a result, nations have proposed action at numerous international forums, such as the Paris Agreement and Kyoto Protocols, to avert an upsurge in CO_2 emissions.

Notwithstanding all attempts, CO_2 emissions levels continue to rise worldwide. The impact of globalization on the manufacturing processes through the transaction of goods and services has ecological significance. In addition, striding down the development path based on fossil fuel makes it difficult for countries to understand the objectives of SDG 7, i.e., inexpensive and renewable energy.[5,6] Furthermore, this challenge may, in due course, lead to a deviation from achieving the SDG 8 objectives, i.e. economic development and sustainable work. In this sense, the upturn in globalization might pose a serious risk to the foundations of real growth in emerging nations. In the context of globalization, trends of utilization of energy and exploitation of natural resources in the Mediterranean countries necessitate significant attention. Natural resources and energy play an essential role in the economic expansion of these countries.[7] Although both energy use and natural resources trigger an economic expansion in these countries, they also cause an increase in environmental degradation.

The Eurostat report[8] indicates that these countries face problems in achieving the objectives of SDG 13. All the Mediterranean countries have signed the Kyoto accords, and energy programs have been put in place to improve environmental and energy controls, with the aim of reducing CO_2 emissions by regulating energy usage. These policies are centered on population, globalization and changes that have taken place in the Mediterranean countries. These changes are focused on the premise of sustainability policies, modern living standards, and energy-saving initiatives to mitigate pollution. From an economic point of view, an increase in the aging populace might lead to a labor supply shortage., whilst, from an ecological viewpoint, constructing second houses for the aging populace, rallying them, and changing their home trends might decrease the quality of the environment via cohort and aging effects.[9,10] In addition, long-term and healthcare expenditure is estimated to increase by more than 2% annually, which will greatly affect government expenditure on economic growth, infrastructure, and other fiscal benefits.

The public spending reduction might have a huge effect on the creation of jobs in the Mediterranean nations, tainting the SDG 8 objectives. At the same time, resettlement and mobility of aging people will directly contribute to transport-induced pollution. Similarly, household trend variations may contribute to energy-induced and space heating pollution via systemic shifts in power consumption patterns.[11,12] In such a scenario, lack of energy developments can prove to be vital to the Mediterranean nations, since they are already experiencing increased emissions. Nevertheless, in line with the Eurostat report,[8] these policies might need re-assessment so that mainstreaming of policy can be recommended for these countries to achieve growth in the economy. In short, the aforementioned topic underlines the necessity for a holistic policy agenda for Mediterranean nations that can perform a significant role in achieving the goals of the 2030 SDGs. In this context, the purpose of this study is to examine the influence of aging population (AP), energy utilization natural resource, globalization, and economic development on CO_2 emissions in Mediterranean economies between 1990 and 2018.

The Mediterranean region has a vast potential for green energy (solar and wind). Besides that, the mix of electricity generation is already driven by fossil fuels, and the use of green energy is under-exploited. Nevertheless, attempts have recently been made and the Mediterranean countries have sought to incorporate diverse actions and policies to address environmental and energy issues and develop green energy. Such initiatives include Mediterranean Solar Plan (MSP), Renewable Energy Solution for the Mediterranean (RES4MED), and Strategy for Sustainable Development (MSSD). The selection of Mediterranean countries is inspired by the fact that no prior study assesses the impact of AP, globalization, real growth, and natural resource on CO_2 emissions in Mediterranean economies. This research sheds light on the possible sources and directions of the relationship between CO_2 emissions, and economic growth, natural resource, utilization of energy, and globalization. The research can also offer concepts on the design and execution of potential energy and economic initiatives in the region. In order to establish the research objectives, the following research questions are proposed: (1) What is the role of total natural resource rent in reducing carbon emissions in the Mediterranean countries?; (2) Is there an association between economic expansion and environmental degradation in this region?; (3) Does AP contribute to reducing pollutant emissions?; and (4) What is the impact of the increasing utilization of energy on the environmental sustainability in the Mediterranean countries?

Now, assessing the impact of policy criteria, taking into account economic spillover effects and systemic similarities, requires an investigation to be conducted by applying the second-generation techniques since the first-generation techniques do not take into account cross-sectional heterogeneity. Therefore, the quantile and Driscoll-Kraay OLS regression methods are utilized to capture the interconnection between CO_2 emissions and the regressors in each quantile. The benefit of the QR is that it allows cross-section dependency, heteroscedasticity, and serial correlation to be taken into consideration.

The remaining part of the study is as follows: Prior studies conducted are presented in Literature review. The theoretical framework is depicted in Data and methodology. The methodology and data utilized are presented in Empirical results and discussion. Finally, concluding remarks and policy suggestions provides in the last section.

Literature review

This section of the study discusses prior studies conducted on the association between CO_2 as a proxy of environmental degradation and economic growth, AP, utilization of energy, natural resource, and globalization.

Environmental degradation and economic growth

Over the years, the EKC hypothesis has been widely discussed in the energy and environmental economics literature.[3,13,14,15]. In the EKC hypothesis, environmental quality is affected by economic growth through three distinct stages namely; scale, technique, and composition effects.[16-18] The hypothesis of EKC also recognizes the position of economic indicators, including economic globalization (EG), natural resource, and the AP.[19] Several studies[2,5,20-26] considered utilization of energy as the major driver of economic expansion, which triggers an increase in CO_2 emissions leading to global warming. The study of Zhang et al.[27] in Malaysia established that increase in energy use triggers sustainable growth and global warming. This view is supported by Rjoub et al.[28] for Turkey, Adedoyin and Zakari[29] for the United Kingdom, Udi et al.[30] for South Africa, and Balsalobre-Lorente et al.[11,31] for Spain. Adedoyin et al.[32] disclosed that energy use plays a significant role in an economic expansion, which, in, turn leads to environmental pollution. This outcome is validated by the study of Olanrewaju et al.[3] in Thailand. A comprehensive study on the energy use-economic growth-environmental degradation was conducted by Shahbaz and Sinha.[33] The above studies revealed that energy utilization plays a significant role in economic expansion, which increases CO_2 emissions causing ecological destruction.

Environmental degradation and globalization

In order to increase globalization, a constant and multidimensional integration mechanism is being pursued to consolidate social, political, and economic ties throughout the world. Globalization is expected to impact economic expansion positively.[16] Over the years, numerous scholars (e.g[14,16,34-38]) have examined the effect of globalization on environmental degradation. Using dual approach and FMOLS techniques, Kirikkaleli et al.[14] assessed the association between environmental sustainability and globalization in Turkey. The empirical outcome shows that globalization decreases environmental sustainability. In Brazil, Usman et al. (2020) uncovered unidirectional causality from globalization to CO_2 emissions, while Kahuthu[39] assessed the globalisation-GDP-CO_2 relationship and found a clear linkage between economic integration and environmental sustainability. It means that globalization permits governments to change trade strategies by decreasing trade barriers to the import of energy-efficient technologies. In their study in Mexico, He et al.[16] established that globalization exerts a positive impact on CO_2 emission, which implies that an upsurge in globalization worsens the quality of the environment. Besides, there is a unidirectional causal linkage from globalization to CO_2 pollution as revealed by the frequency domain causality test.

Likewise, Shahbaz et al.[40] found a positive association between CO_2 emissions and globalization in India. This outcome is supported by the Dollar and Kraay,[41] and Leal and Marques[42] who established positive interconnection between globalization and CO_2 emissions. The empirical proof of the research reported that globalization was detrimental to environmental sustainability. This supporting proof has also been backed by research conducted in a variety of situations (e.g.[14,43]). For instance, Shahbaz et al.[44] showed that globalization facilitates FDI that can further result in the utilization of lower cost and dirtier industrial methods to exploit natural resources to make increased revenues. It indicates that the increase in environmental degradation may be due to the weak implementation of environmental initiatives. Nonetheless, Shahbaz et al.[45] established a negative linkage between CO_2 emissions and globalization in Australia, which implies that globalization could have an additional impact on the administration of environmental initiatives and resources allocation. Likewise, the study by Rahman[46] on the top 10 electricity-consuming countries established that globalization exerts a negative impact on CO_2 emissions, which demonstrates that an increase in globalization enhances the environmental quality.

Environmental degradation and natural resources

Numerous researches show that the existence of ample natural capital performs a vital role in economic systems. Auty[47] noted that GDP growth is slower in nations with plentiful resources abundance. That being said, Bravo-Ortega and De Gregorio[48] established that natural resources had a positive effect on income, but had a negative impact on their development rate. This confirmed the "resource curse hypothesis".[24,25,49] In line with the aforementioned theory, Brunnschweiler and Bulte[50] established that there is a difference between natural resource abundance and natural resource dependance. They reached the conclusion that dependance on natural resources did not affect GDP growth, but the ample of natural resources increased economic growth. Moreover, Nathaniel et al.[7] and Pata & Isik,[51] established a positive linkage between CO_2 emissions and natural resources in Latin American and Caribbean countries. Similarly, Wang et al.[52] revealed a positive linkage between natural resource rent and CO_2 emissions. Contrarily, Balsalobre-Lorente et al.[53] established negative interconnection between natural resources and CO_2 emissions, which implies that an upsurge in natural resources reduces environmental degradation in European countries. Furthermore, in the USA, Khan et al.[24,25] exposed that resource rent exerts a negative impact on CO_2 emissions, implying that natural resource rent increases environmental sustainability. The outcomes demonstrated that resource-abundant countries have enacted import-substitution for fossil fuels and dependance on energy and have favored using technology that is energy-efficient to preserve living standards and economic expansion. Nonetheless, a study by Baloch et al.[54] using the BRICS economies has a case study that produced counter-evidence. Likewise, the research of Pata et al.[55] in top 10 nations disclosed that an upsurge in the use of natural resource mitigate the quality of the environment.

Environmental degradation and aging population

Bearing in mind the effect of aging on CO_2 pollution, some scholars have assessed the association between carbon emissions and aging.[56] Societies with a high percentage of employes will face more carbon emissions.[57] Similarly, Fan et al.[58] affirmed a positive association between carbon emissions and working-age population in low-income nations while there is evidence of a negative association between carbon emissions and working-age population in high-income economies. Hassan and Salim[59] estimated that a 1% rise in the proportion of the elderly population results in a 1.55% reduction in CO_2 emissions. Nevertheless, O'Neill et al.[60] reported that the populace system has an indirect impact on CO_2 pollution, which operates through the complexities of the labor market. In this analysis, the aging workforce is linked to a lower rate of labor participation, which reduces economic activity and reduces CO_2 pollution.

On the opposite side, other surveys have given proof of the detrimental effect on ecosystem quality of the aging populace. For example, Farzin and Bond[56] found that communities with high age dependency undergo increased CO_2 pollution. Comparably, Menz and Welsch[61] disclosed that old people eat more energy-intensive products, increasing CO_2 emissions. Contrarily, some research established a negative linkage between AP and environmental pollution. For example, Farzin and Bond[56] revealed that AP exerts a positive impact on CO_2 emissions. Likewise, Menz and Welsch[61] found a positive linkage between elderly people and CO_2 emissions. Using OECD countries, Menz and Welsch[62] examined the interconnection between AP and CO_2 emissions and their outcomes showed a positive and significant linkage. Furthermore, on the grounds of some findings, the impact of AP is linked to age-specific demand for energy in various sectors of production and consumption. As stated by Heijdra, Kooiman, and Ligthart,[63] older individuals would undoubtedly be opposed to stringent environmental regulations. As regard the connection between ecological preferences and age-dependance, Thalmann[64] demonstrated that the tendency to spend on improved quality of the environment reduced substantially with age. The results of the study suggest that, although senior individuals would bear the costs immediately, they will not gain from higher ecological sustainability in the long term, which will progressively reduce ecological consciousness.

Based on the studies reviewed, there is evidence that all the parameters of interest have a substantial impact on environmental degradation. Nonetheless, their findings are mixed, which gives room for further studies on the association between CO_2 emissions and the selected variables of interest. While the criteria could be influential in the creation of sustainable development strategies, their positions in the literature have been generally undermined. In addition, the validity of the EKC hypothesis as an analytical method for policy making has also not been addressed in the prior studies. This discrepancy is filled by recognizing aging in the multi-pronged SDG paradigm proposed in this research.

Data and methodology

To accomplish the purposes of this analysis, we utilized panel data from selected Mediterranean countries from the 1995–2016 period (See list in Appendix 1). The sample time and the nations are determined by the accessibility of data although, in a broader context, the sample nations should include clear details on the connection regarding economic growth-resources-environment in the area. The pollution of CO_2 reflects ecological deprivation caused by natural resources rent (TNR), gross domestic products =(Y), energy use (EU), AP and EG. Data for factors are collected from the World Bank's World Development Indicators (https://data.worldbank.org/indicator), except EG which was sourced from KOF database[65] and energy use from British Petroleum (https://www.bpcom.co.uk/bp/Pages/default.html). Table 1 gives a summary of the description of the variables:

Table 2 shows the descriptive statistics and correlation analysis for the study. However, it can be observed from the table that income has the highest mean of 9.193 million dollars per year, a minimum of 6.768 million dollars per year and a maximum of 10.648 million dollars per year. And carbon emission has the lowest mean of −0.896 metric tonnes per year, a minimum of −2.240 metric tonnes per year and maximum of 0.320 metric tonnes per year. The outcome of this study validate that all the series are not normally distributed, it of this reason why the authors chose quantile regression to solve the problem.[66-69] On the other hand, the correlation analysis proves that carbon emission has a negatively significant relationship with income, EG, and AP but has positive significance with total natural resources and energy use. Moreover, income has a positive significant relationship with EG and AP but has a negative relationship with total natural resources and energy use. The total natural resource has a negative significant relationship with both EG and AP, but a positive significant relationship with energy use. Nevertheless, EG has a positive significant relationship with AP and a negative significant relationship with energy use. AP, on the other hand, has a negative significant relationship with energy use.

Table 1. Description of variables.

Name of indicator	Abbreviation	Proxy/scale of measurement	Source
Carbon dioxide emissions per capita	CO_2	Measured in metric tonnes	WDI
Income	Y	It is proxied by the gross domestic product per capita (2010 Constant USD)	WDI
Square of income	Y^2	It measures the square of GDP per capita	WDI
Total natural resources rents	TNR	% of real GDP	WDI
Square of total natural resources rents	TNR^2	It measures the square of TNR	WDI
Energy use	EU	kg of oil equivalent	BP
Aging population	AP	Population aged 65 and above (% of total population)	WDI
Economic globalization	EG	KOF globalization index	Gygli et al.[65]

Note: All variables are transformed to their natural logarithm form to ensure homoscedasticity of the coefficients.

Table 2. Descriptive statistics and correlation matrix.

	LCO_2	LY	LTNR	LEG	LAP	LEU
Mean	–0.896	9.193	–0.859	4.217	2.322	4.484
Median	–0.975	9.301	–0.864	4.226	2.351	4.462
Maximum	0.320	10.648	3.564	4.472	3.101	5.244
Minimum	–2.240	6.768	–7.438	3.638	1.287	4.099
Std. Dev.	0.591	1.100	2.322	0.178	0.498	0.211
Skewness	0.045	–0.148	–0.192	–0.802	–0.206	1.121
Kurtosis	2.261	1.422	2.680	3.161	1.657	4.921
Jarque-Bera	7.098**	33.061***	3.218***	33.414***	25.309***	111.999***
Probability	0.028	0.000	0.000	0.000	0.000	0.000
Observations	308	308	308	308	308	308
LCO_2	1					
LY	–0.8458***	1				
LTNR	0.6819***	–0.6890***	1			
LEG	–0.7110***	0.8164***	–0.5491***	1		
LAP	–0.6981***	0.8182***	–0.5928***	0.7093***	1	
LEU	0.5574***	–0.3643***	0.1852***	–0.4170***	–0.1610***	1

Note: *<0.01, **<0.05, ***<0.10.

The equation below presents the model subject of our analysis, firstly in a functional form:

$$CO_2 = f\ (Y,\ TNR,\ EU,\ AP,\ EG) \tag{1}$$

The continuous stochastic form of the connection regarding the depletion of the ecology, income, total natural resources rent, energy use, AP and EG as:

$$CO_{2i,\,t} = \beta 0 + \beta 1\, Yi,\ \ t,\ \ + \beta 2\, TNRi,\, t,\ \ + \beta 3\, EUi,\, t,\ \ + \beta 4\, APi,\, t,\ \ + \beta 5\, EG_{i,t,} + \varepsilon_{i,t} \quad (2)$$

given that *i* and *t* signify the cross-sectional and time units of the study (1995–2016) as mentioned earlier, whereas ε captures the error term. Please refer to Table 1 for the explanation of other variables as presented earlier. Next, we add the square form of income and natural resources rent to help in the estimation of the Environmental Kuznet curve (EKC) which shows the U-shaped connection as reported in the equation:

$$\begin{aligned} CO_{2i,\,t} = {} & \beta 0 + \beta 1\, Yi,\ \ t,\ \ + \beta 2\, Y2i,\ \ t,\ \ + \beta 4\, TNRi,\, t, \\ & + \beta 3\, TNR2i,\, t,\ \ \beta 4\, EUi,\, t,\ \ + \beta 5\, APi,\, t,\ \ + \beta 6\, EG_{i,t,} + \varepsilon_{i,t} \end{aligned} \quad (3)$$

where Y, Y^2, TNR, TNR^2, EU, AP, and EG represent income, square of income, total natural resources, square of total natural resources, energy use, AP, and EG, respectively.

However, Binder and Coad[70] expressed their opinion that, because they relied on mean results, conventional regression approaches such as OLS could contribute to underestimating or over-estimating significant coefficients or could not define meaningful connections. Thus, the quantile regression presented in the pioneering study by Koenker and Bassett[71] functions well because it provides a generalization to other quartiles of the medium regression study. In comparison, even though conventional regression rules do not apply, quantile regression may offer a solid approximation. Again**,** unlike ordinary regression analysis, quantile regression uses the calculation of sequence variables that point to the least absolute deviation (LAD) to minimize the sum of the actual numbers of balanced sequences.[71,72] However, compared with OLS, the LAD method has some advantages, including tolerance and exposure to external data. This is because only marginal instructions are used in this process. The projection is usually more stable than the average, and, in the case of heterogeneity, the quantile regression is more accurate than the ordinal least squares regression. In the subsequent variants, a quantile template panel is defined according to Ismail, Loganathan, Streimikiene, Mardani, and Wan Endut[73] and Halliru, Loganathan, and Golam Hassan[74] as:

$$\begin{aligned} QCO_{2i,\,t}(\delta / \kappa it) = {} & \beta 0(\delta) + \beta 1(\delta)\, Yi,\ \ t, \\ & + \beta 2(\delta)\, FY2i,\ \ t,\ \ + \beta 3(\delta)\, TNRi,\ \ t, \\ & + \beta 4(\delta)\, TNR2i,\, t,\ \ + \beta 5(\delta)\, EUi,\, t, \\ & + \beta 6(\delta)\, APi,\, t,\ \ + \beta 7(\delta)\, EG_{i,t,} + \varepsilon_{i,t} \end{aligned} \quad (4)$$

where, $QCO_{2i,\,t}(\delta/\kappa it)$ is the δth provisional quantile of the explained variable, κ_i stand for the vector of the explanatory variables for every nation i at time t for the quantile δ, where, the β's was denoted as intercept of the explanatory variables for the quantile δ. For robustness purposes, the Driscoll-Kraay OLS as proposed by Pesaran[75] was used.

We develop assumptions with respect to the variables in the analysis focusing on the existing literature. According to the inverted U-shaped EKC hypothesis, we speculated that income had a positive influence on carbon pollution, suggesting an improvement in pollution during the new stage of economic development. Income squared is believed to negatively affect carbon pollution as a result of pollution reductions as the threshold is met. We believed that total natural resources would increase emissions in the nations by raising the inflows of ecologically conscious items in the initial stage and decreases emissions, which squared. Furthermore, we have speculated that AP will decrease ecological degradation, whereas both energy use and EG raise pollutants.

Empirical results and discussion

Cross-section dependency (CD) test

Unlike the widely used traditional econometric method, this study relies on the analytical research that precedes it. It is necessary to consider all the potential issues before performing any unit root tests, cointegration tests, and long-run estimation. Hence, this analysis first established a regression equation that checked for homogeneity in the cross-section results. Disregarding what is defined in the long-time panel data set will tip to improper assessment consequences.[76] This idea is the reason why we tested for cross-sectional dependency by utilizing the Pesaran[77] LM test, Pesaran[78] CD test, and the Breusch and Pagan[79] Lagrangian Multiplier test. Issues presented by cross-sectional dependance are of concern due to the growing convergence of the global economy. Many nations are less independent of one another and have a greater vulnerability to related shocks.[80,81] These various states have different economies and policies, presuming that homogeneity can lead to misleading outcomes. The research evaluated the hypotheses that the cross-sectional dependency hypothesis was correct and that was valid. outcomes in Table 3 demonstrate that, from the Pesaran[77] LM, Pesaran[78] CD, and the Breusch-Pagan LM[79] dependency measures, the freedom of the cross-sections is endorsed by the null assumption. Hence, all the variables are dependent on each other over time. The findings from the CD test are the basis for the new approaches used for the regression analysis.

Stationarity test

When the findings showed that the panel figures were cross-based, stationarity estimations of the second generation were unacceptable to fail to refute the null hypothesis where first-generation estimations were also run for robustness check. Thus, it became necessary to incorporate a unit root test to resolve the cross-sectional dependance problem. Then the Im, Pesaran and Shin[82] (IPS) and cross-sectionally augmented IPS panel unit root (CIPS)[78] methods were used to help decide if a model has a unit root. Using this method, it was easier to evaluate the incorporation of all parameters. These methods are suitable since they can detect heterogeneity within and between panels even though it is recognized as a very necessary or significant technique for the evaluation of the generation of the second order in panel research. The basic configuration of CIPS is as follows;

$$\begin{aligned}\Delta \mathrm{CAi},\ \mathrm{t} = & \Phi \mathrm{i} + \Phi \mathrm{iZi},\ \mathrm{t} - 1 + \Phi \mathrm{iCA\AA it} - 1 \\ & + \Sigma^{\mathrm{p}}_{(1\,=\,0)} \Phi \mathrm{il} \Delta \mathrm{CAt} - 1 + \Sigma^{\mathrm{p}}_{(\mathrm{i}\,=\,0)} \Phi \mathrm{il} \Delta \mathrm{CAi},\ \mathrm{t1} + \mu \mathrm{it}\end{aligned} \tag{5}$$

Table 3. Cross-sectional dependency (CD) estimation outcome.

Model	Pesaran[78] CD test	Pesaran[77] LM test	Breusch and Pagan[79] LM test
LCO_2 = f(LY,LY2, LTNR, LTNR2, LEG, LAP, LEU)	−0.792**	12.284***	1580.77***
p-value	(0.028)	(0.0000)	(0.0000)

Note: *<0.01, **<0.05, ***<0.10.

whereas $CA_{\bar{i}t-1}$ and $\Delta CA_{i,t1}$ denote cross-section average. The CIPS statistic is also shown below as:

$$CIPS_{2007} = N^{-1} \sum_{i=0}^{n} CDFi \tag{6}$$

whereas, CDF is cross-sectional augmented Dickey-Fuller (CADF) given in equation (6).

Such methods are preferred to offer us the ability to answer the problem of weak-strength produced in a pseudo-stationary collection of data and to benefit from the additional information provided in the check outcomes by a joint cross-sectional time series for intensity. In Table 3 the findings confirm that the parameters have integration of Series one, so the results are similar; it revealed that all the variables are significant at first difference, for instance, CO_2, is identified to be stationary at position [I (1)] underneath the heterogeneity alteration system. As seen in Table 4, it showed that all the parameters were stationary at first difference indicating that the factors were suitable for study and that the effects could be used to make decision assessments.

Cointegration test results

Determining that the second-generation co-integration model is more suitable for this data necessitated the use of the proposed approach by Westerlund.[83] The second-generation time series model is sensitive enough to detect co-integration even with cross-dependance estimation problems and finds that there is no involvement of association as stated by the null assumption. The numerically represented findings from Table 5 show that the null statement must be dismissed. The results seen are long run-in nature in that they can affect the dependent factor in the long run. It says that the factors are strongly correlated with portfolio output at the 1% and 5% significance stages, and there is a long-run impact on portfolio creativity.

After affirming the long-run connection regarding the variables, it was necessary to identify the long-run association utilizing the quantile regress (QR) while OLS was used as robustness checks for the analysis, which is also presented in Figure 1 below. From the OLS analysis, it was observed that both total natural resources rent and income showed inverted U-shape. AP has a negative connection with pollutant while both EG and energy use have a positive relationship.

Table 4. Unit root estimation.

	CIPS				IPS			
	I(0)		I(1)		I(0)		I(1)	
Variables	**C**	**C&T**	**C**	**C&T**	**C**	**C&T**	**C**	**C&T**
LCO_2	−2.221	−2.660	−5.185***	−5.264***	−0.861	0.391	−5.868***	−6.210***
LY	−1.324	−2.561	−3.713***	−3.930***	−1.767	−1.381	−4.416***	−4.331***
LY2	−2.141	−2.162	−3.823***	−4.910***	−1.749	0.122	−5.775***	−6.097***
LTNR	−2.301	−2.261	−4.498***	−4.497***	−1.714	−1.687	−4.455***	−8.235***
LTNR2	−2.131	−1.221	−4.591***	−5.487***	−1.598	−1.361	−8.025***	−4.542***
LEG	−2.447	−2.762	−4.313***	−4.520***	−1.750	−1.690	−7.357***	−8.707***
LAP	−1.486	−0.774	−2.625***	−3.438***	−1.136	−1.659	−3.070***	−3.690***
LEU	−2.848	−2.109	−5.244***	−5.340***	−0.987	−2.988	−5.926***	−5.890***

Note: *<0.01, **<0.05, ***<0.10.

Table 5. Westerlund[83] cointegration test.

Statistics	Value	*p*-value
Gτ	−1.848**	(0.030)
Gα	−1.606**	(0.036)
Pτ	−2.053**	(0.041)
Pα	−1.315**	(0.010)

Note: *<0.01, **<0.05, ***<0.10.

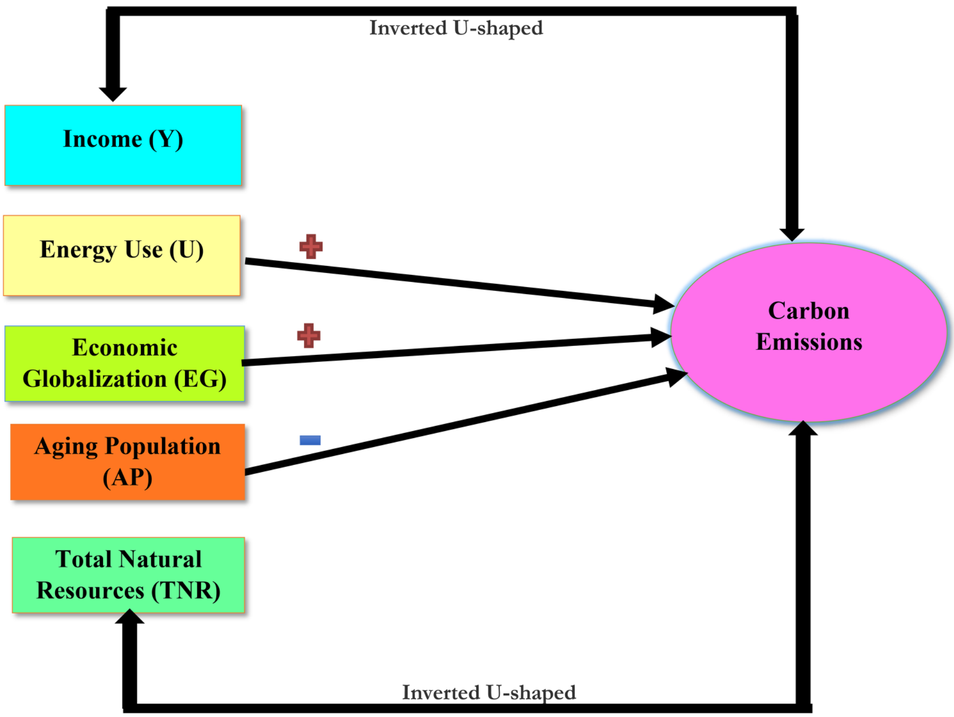


Figure 1. Graphical outcomes.

By concentration on the quantile regression, which was the main analytical estimation technique, the Y, which denotes as economic development, has a positive significant association with emission in all the quantile analyzes and it affirms the findings of Waqih, Bhutto, Ghumro, Kumar, and Salam[84]; Gyamfi, Bein, Ozturk, and Bekun[85]; Bekun et al.[86,87] This finding supports our assertion that the economic handlers of the Mediterranean region are focusing on achieving their economic goals with much emphasis on the environment. Most emerging economics, including most of the Mediterranean countries, in our study are after increasing and achieving their economic goals at the expense of their environmental quality. Moreover, the square of income proves the presence of EKC from the estimation, which shows that the square of income has a negative relationship with emission. The outcomes then support that of Hanif, Raza, Gago-de-Santos, and Abbas[88] and Destek and Sinha[89] in which their outcomes indicated a similar inverted U-shape in their respective studies.

The finding further shows that, natural resources rent have positive relationship with emission whiles its square negatively associate it emission for all the quantiles. This shows that, climate's perceptually progressive effects on resources have an inverted U-shaped effect on the environment. This seems to show that, with time, their increasing need for resources will cause the reduction of carbon emissions. Nevertheless, the turnaround points for this relation are within the normal range, as these points are within the tolerable limits, suggesting that, if the Mediterranean countries manage their natural resources well, it will have no effect on the ecology. However, according to Bekun et al.[86], the industries within these countries are de-energized and, therefore, environmentally burdensome. These findings are in line with the study of Balsalobre-Lorente et al.[11,31] for European economies.

From the analysis, it can be seen that the AP has a negative impact on the environment from all quantiles. As observed, a decline in pollution has been seen in the Mediterranean region due to demographic moves during the last decade. It affirms the finding of Balsalobre-Lorente et al.[11,31] but fail to affirm those of Hamza and Gilroy.[90]

Furthermore, there is a positive association between EG and pollution, which was shown from all the quantiles. The outcome suggests that openness to trade with the outside world is creating more environmental issues for the Mediterranean region and does not affirm with the work of Rudolph and Figge[91] that states that globalization decreases emissions but however affirms the work of Onifade et al.[92] for E7 economies.

Nevertheless, the outcome shows some form of a positive relationship between environmental degradation and energy use in all the categories. Positive is registered between energy consumption and the environment, and this is a pointer that economic growth of Mediterranean region is energy-led growth anchored on fossil fuel energy use, which has a high propensity of dilapidating the environment of countries involved. This reveals that most countries in the Mediterranean region are still behind the technological innovations that pave ways for clean production and economic performance. This supports the findings of Al-Mulali and Tang,[93] Jia, Klemeš, Varbanov, and Wan Alwi,[94] Udemba and Agha[95] and Steve et al.[96]

Table 6. Qr and Driscoll-Kraay OLS result for a long-run relationship.

	Q.05	Q.25	Q.50	Q.75	Q.95	Driscoll-Kraay OLS
Dependent variable: LCO_2						
LY	0.0851*	0.0722***	0.1008***	0.1877***	0.1286***	0.2368***
LY^2	−6.79e***	−3.55e***	−7.76e***	−1.18e**	−3.47e***	−3.10e***
LTNR	0.1195***	0.0620***	0.0912***	0.0549***	0.0537***	0.0054**
$LTNR^2$	−0.0030	−0.0119**	−0.0108*	−0.0022***	−0.0029***	−0.0016***
LEG	0.6062***	0.0116**	0.2066**	0.4612**	0.2513***	0.2073**
LAP	−0.2388***	−0.1066**	−0.1278**	−0.2281***	−0.2216***	−0.5493***
LEU	0.7626***	1.0819***	1.0402***	1.2959***	1.0073***	0.7887***
C	−6.9819***	−4.5619***	−6.7920***	−6.1168***	−4.2829***	−6.0620***
R2/Pseudo R2	0.6819	0.6734	0.6734	0.7003	0.7182	0.4923
Observation	308	308	308	308	308	308
Wald test						432.82***
No. Regressors	7	7	7	7	7	7
No. Group	14	14	14	14	14	14

Note: *<0.01, **<0.05, ***<0.10.

Table 7. Dumitrescu and Hurlin panel causality test.

	W-stat.	Zbar-stat.	p-value	CAUSALITY FLOW
LY → LCO_2	3.566*	1.747	(0.0805)	LY ↔ LCO_2
LCO_2 → LY	3.842**	2.130	(0.0331)	
LTNR → LCO_2	2.351	0.060	(0.9519)	LnY ≠ LnTNR
LCO_2 → LTNR	2.226	−0.112	(0.9106)	
LEG → LCO_2	3.492*	1.645	(0.0999)	LnEG → LnY
LCO_2 → LEG	2.564	0.356	(0.7216)	
LAP → LCO_2	3.724**	1.967	(0.0491)	LAP ↔ LCO_2
LCO_2 → LAP	11.484***	12.742	(0.0000)	
LEU → LCO_2	3.266	1.331	(0.1830)	LEU ≠ LCO_2
LCO_2 → LEU	2.181	−0.175	(0.8609)	

Note: *<0.01, **<0.05, ***<0.10.

Tables 6 and 7 exhibits the outcome of the pairwise Dumitrescu and Hurlin[97] panel causality technique. It was observed that there is a feedback causal relationship regarding the following variables: income and pollution as well as AP and pollution. The outcomes from the feedback causality reveal that increasing pollution in the Mediterranean region can wrongly have an impact on economic development pattern by creating an effect on the health of the population, which aspect can be seen from the impact of pollution on the AP.

Moreover, a one-way directional causality was found regarding carbon emission and EG, which indicates that, when industrialization increases, it sets pace for openness, which will produce more emissions that affect the environment.

Concluding remarks and policy suggestions

The Mediterranean region is known for rich natural and human resources capable of attracting prospective investors from across the globe. With the current concern over the increasing climate change, which is associated with different factors, divided views have emerged regarding the impact of income levels and natural resources rent on climate change through direct impact on the environment. Some scholars support positive impact of natural resources, while others are refuted this.

The invented U-shape EKC for both income and natural resources rent was looked at from 1995–2016, which was not previously examined for the Mediterranean region to the knowledge of the authors. Scientific approaches such as Pesaran[77] LM test, Pesaran[78] CD and Breusch-Pagan[79] LM test to evaluate for cross-sectional dependance as well as Pesaran[78] and Im et al.[82] panel root unit test to evaluate the integration features of variables were utilized. We then utilized the Westerlund[83] test to analyze the long-run equilibrium among variables. To evaluate the long-run coefficients of the variables, Driscoll-Kraay OLS and the quantile regression (QR) tests were also applied. The study emphasizes more on the quantile regression technique which has a superior outcome than the others and which was used for sensitivity check.

The result reviewed an invented U-shape regarding both income and natural resource rent on CO_2 pollution, which shows the presence of the Environmental Kuznets curve (EKC) hypothesis for the Mediterranean region during the investigated duration. Moreover, EG and energy use both were identified as not environmentally friendly by which AP decreases emissions.

From the causality technique, feedback was found on a causal relationship regarding the following variables: income and pollution as well as AP and pollution in which a one-way directional causality was found regarding carbon emission and EG.

Following the findings from our study, the following policies are recommended for the countries in the Mediterranean region.

At the beginning of the growth trajectories, the concern about the environment increases as a result of industrial development and the pursuit of economic sustainability becomes more crucial. Some nations try to have better development, even at the expense of the environment. With rising income and expansion, the business environment has moved from heavy industry to light industry. Moreover, with the growth of industrial production, globalization provides greater access to more modern technology in the economy. Employment generated in this system could perhaps focus on raising the life quality of the populace and including the young might help. It is crucial to long-term growth because it safeguards intergenerational fairness, which is the backbone of sustainability

While discussing sustainable development, it is essential to discuss the various purposes of SDGs, which can be discussed via the findings of our research. In this quest, we must deal with the energy strategies of these countries so that economic development is not only sustainable, but also inclusive. The problems of ecological destruction, accessibility of renewable energy, green environments, and societies, responsible consumer, and security as well as healthy living can be adequately achieved by tackling energy strategies Thus, to substitute the currently used fossil fuel, a clean form of energy needs to be introduced within the countries via technological advancement as well as endogenous and exogenous R&D.

Moreover, it should also be remembered that the reservoir of natural resources will serve as a cause for ecological problems Economic growth is typically achieved by extracting or destroying the stock of natural resources during the early expansion process. Interestingly, with growing public knowledge of profits as well as the ecosystem, a reservoir of natural resources begins to grow, helping to create new habitats. The existence of ample natural resources contributes to the absorption of extra greenhouse gasses (GHGs), thus providing an environmentally sustainable environment. The countries, therefore, must have stringent strategies to safeguard natural resources and their people and to specifically define the rights to land for the usage of social infrastructure. These regulatory guidelines may help to accomplish the aim of the following three SDGs (7, 8 and 13).

According to the findings, policymakers in the Mediterranean region must take EG into account when developing and enforcing climate change measures to achieve the net-zero emissions target. As a result, given that EG worsens carbon emissions across the board, policymakers in the Mediterranean region should not overlook the impact of EG on climate change and should take this into consideration when developing and implementing an environmental sustainability policy framework. Failure to incorporate EG into carbon emission forecasting models and environmental regulations may jeopardize the Mediterranean region's efforts to achieve the net-zero emissions objective set by the United Nations (SDG's).

In addition to the debate on the strategy proposals for decision-makers, the industrial participants need to be included in the process to ensure the effectiveness of the regulatory framework. The industry must focus on the use of sustainable energy technologies by eliminating conventional fossil fuel approaches to maintain the policy structure. This change should be made phase-by-phase with the authorities to ensure that the income source stays intact. During this process of transition, the business area must also examine the issue of creating jobs in order to prevent technical advances from replacing human labor. The whole policy system will not survive beyond this element. When addressing the policy goals, it needs to evoke the basic premises without whom the strategy platform will be unsuccessful. Firstly, traded innovations should be environmentally sensitive because they can monitor adverse ecological impacts taking a step in the SDG 13 goals. Secondly, energy developments should be defined in phase, as an immediate replacement of fossil fuel approaches can undermine the trajectory of development. Thirdly, successful environmental sustainability needs the involvement of citizens. This suggests that public-private collaborations must be strengthened, as this might encourage decision-makers to focus on the local level.

Finally, there are certain drawbacks to this study which are certain pollution variables were not included either because of the data inaccessibility and limitations. It would be important to see if financial development could reduce the destructive environmental effects of the exploitation of natural resources and globalization. This is a hint for potential future studies to explore.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iDs

Bright Akwasi Gyamfi https://orcid.org/0000-0002-7567-9885
Festus Victor Bekun https://orcid.org/0000-0002-0464-4677

References

1. Kirikkaleli D, Güngör H and Adebayo TS. Consumption-based carbon emissions, renewable energy consumption, financial development and economic growth in Chile. *Bus Strategy Environ* 2021; 2: 23–31.
2. Bekun FV, Alola AA and Sarkodie SA. Toward a sustainable environment: nexus between CO2 emissions, resource rent, renewable and nonrenewable energy in 16-EU countries. *Sci Total Environ* 2019; 657: 1023–1029.
3. Olanrewaju VO, Adebayo TS, Akinsola GD, et al. Determinants of environmental degradation in Thailand: empirical evidence from ARDL and wavelet coherence approaches. *Pollution* 2021; 7: 181–196.
4. Asumadu-Sarkodie S and Owusu PA. The causal effect of carbon dioxide emissions, electricity consumption, economic growth, and industrialization in Sierra Leone. *Energy Sources, Part B: Econ, Plan Policy* 2017; 12: 32–39.
5. Alola AA, Adebayo TS and Onifade ST. Examining the dynamics of ecological footprint in China with spectral Granger causality and quantile-on-quantile approaches. *Int J Sustain Dev World Ecol* 2021: 1–14. https://doi.org/10.1080/13504509.2021.1990158
6. Adebayo TS, Rjoub H, Akadiri SS, et al. The role of economic complexity in the environmental Kuznets curve of MINT economies: evidence from method of moments quantile regression. *Environ Sci Pollut Res* 2021: 1–13. https://doi.org/10.1007/s11356-021-17524-0
7. Nathaniel SP, Nwulu N and Bekun F. Natural resource, globalization, urbanization, human capital, and environmental degradation in Latin American and Caribbean countries. *Environ Sci Pollut Res* 2021; 28: 6207–6221.
8. Eurostat. *Sustainable development in the European Union d monitoring report on progress towards the SDGs in an EU context d 2019 edition*. European Commission, 2019. https://ec.europa.eu/eurostat/web/sdi.Accessed 21 August 2021
9. Carvalho TS, Santiago FS and Perobelli FS. Demographic change in Brazil and its impacts on CO2 emissions. *Econ Syst Res* 2021; 33(2): 197–213.
10. Zeeshan K, Ahmad M, Rahman ZU, et al. Can innovation shocks determine CO2 emissions (CO2e) in the OECD economies? A new perspective. *Econ Innov New Technol* 2021; 30: 89–109.

11. Balsalobre-Lorente D, Driha OM, Bekun FV, et al. The asymmetric impact of air transport on economic growth in Spain: fresh evidence from the tourism-led growth hypothesis. *Curr Issues Tour* 2021a; 24: 503–519.
12. Akadiri SS, Adebayo TS, Adedapo AT, et al. Does interaction between technological innovation and natural resource rent impact environmental degradation in newly industrialized countries? New evidence from method of moments quantile regression. *Environ Sci Pollut Res* 2022; 29: 3162–3169. https://doi.org/10.1007/s11356-021-17631-y
13. Grossman GM and Krueger AB. *Environmental impacts of a North American free trade agreement (No. w3914)*. London: National Bureau of Economic Research, 1991.
14. Kirikkaleli D, Adebayo TS, Khan Z, et al. Does globalization matter for ecological footprint in Turkey? Evidence from dual adjustment approach. *Environ Sci Pollut Res* 2021; 28(11): 14009–14017.
15. Panayotou T. Demystifying the environmental Kuznets curve: turning a black box into a policy tool. *Environ. Dev. Econ* 1997; 2(4): 465–484.
16. He X, Adebayo TS, Kirikkaleli D, et al. Consumption-based carbon emissions in Mexico: An analysis using the dual adjustment approach. *Sustain Prod Consum* 2021; 27: 947–957.
17. Bekun FV. Mitigating Emissions in India: accounting for the role of real income, renewable energy consumption and investment in energy. *Int. J. Energy Econ. Policy* 2022; 12(1): 188–192.
18. Odugbesan JA and Adebayo TS. The symmetrical and asymmetrical effects of foreign direct investment and financial development on carbon emission: evidence from Nigeria. *SN Appl. Sci* 2020; 2(12): 1–15.
19. Dooley JJ. Unintended consequences: energy R&D in a deregulated energy market. *Energy Policy* 1998; 26(7): 547–555.
20. Ahmed Z, Wang Z, Mahmood F, et al. Does globalization increase the ecological footprint? Empirical evidence from Malaysia. *Environ Sci Pollut Res* 2019; 26: 18565–18582.
21. Pata UK. The influence of coal and noncarbohydrate energy consumption on CO2 emissions: revisiting the environmental Kuznets curve hypothesis for Turkey. *Energy* 2017; 160: 1115–1123.
22. Pata UK. Renewable energy consumption, urbanization, financial development, income and CO2 emissions in Turkey: testing EKC hypothesis with structural breaks. *J Cleaner Prod* 2018; 187: 770–779.
23. Etokakpan MU, Adedoyin FF, Vedat Y, et al. Does globalization in Turkey induce increased energy consumption: insights into its environmental pros and cons. *Environ Sci Pollut Res* 2020; 27: 26125–26140.
24. Khan I, Hou F and Le HP. The impact of natural resources, energy consumption, and population growth on environmental quality: fresh evidence from the United States of America. *Sci Total Environ* 2021a; 754: 142222.
25. Khan Z, Ali S, Dong K, et al. How does fiscal decentralization affect CO2 emissions? The roles of institutions and human capital. *Energy Econ* 2021b; 94: 105060.
26. Umar M, Ji X, Kirikkaleli D, et al. Environmental cost of natural resources utilization and economic growth: can China shift some burden through globalization for sustainable development?. *Sustain. Dev* 2020; 28(6): 1678–1688.
27. Zhang L, Li Z, Kirikkaleli D, et al. Modeling CO_2 emissions in Malaysia: an application of Maki cointegration and wavelet coherence tests. *Environ. Sci. Pollut. Res* 2021; 28(20): 26030–26044.
28. Rjoub H, Odugbesan JA, Adebayo TS, et al. Sustainability of the moderating role of financial development in the determinants of environmental degradation: evidence from Turkey. *Sustainability* 2021; 13(4): 1844.
29. Adedoyin FF and Zakari A. Energy consumption, economic expansion, and CO_2 emission in the UK: the role of economic policy uncertainty. *Sci. Total Environ* 2020; 738: 140014.
30. Udi J, Bekun FV and Adedoyin FF. Modeling the nexus between coal consumption, FDI inflow and economic expansion: does industrialization matter in South Africa?. *Environ. Sci. Pollut. Res* 2020; 27(10): 10553–10564.
31. Balsalobre-Lorente D, Sinha A, Driha OM, et al. Assessing the impacts of ageing and natural resource extraction on carbon emissions: a proposed policy framework for European economies. *J Cleaner Prod*. 2021; 296: 126470. https://doi.org/10.1016/j.jclepro.2021.126470
32. Adedoyin FF, Gumede MI, Bekun FV, et al. Modelling coal rent, economic growth and CO_2 emissions: does regulatory quality matter in BRICS economies?. *Sci. Total Environ* 2020; 710: 136284.

33. Shahbaz M and Sinha A. Environmental Kuznets curve for CO_2 emissions: a literature survey. *J. Econ. Stud* 2019.
34. Pata UK. Linking renewable energy, globalization, agriculture, CO2 emissions and ecological footprint in BRIC countries: a sustainability perspective. *Renew Energy* 2021; 173: 197–208.
35. Adebayo T, Oladipupo S, Adeshola I, et al. Wavelet analysis of impact of renewable energy consumption and technological innovation on CO2 emissions: evidence from Portugal. *Environ Sci Pollut Res* 2021: 1–18. https://doi.org/10.1007/s11356-021-17708-8
36. Kirikkaleli D and Adebayo TS. Do public-private partnerships in energy and renewable energy consumption matter for consumption-based carbon dioxide emissions in India? *Environ Sci Pollut Res* 2021; 28: 30139–30152. https://doi.org/10.1007/s11356-021-12692-5
37. Pata UK and Caglar AE. Investigating the EKC hypothesis with renewable energy consumption, human capital, globalization and trade openness for China: evidence from augmented ARDL approach with a structural break. *Energy* 2021; 216: 119220.
38. Pata UK and Yilanci V. Financial development, globalization and ecological footprint in G7: further evidence from threshold cointegration and fractional frequency causality tests. *Environ Ecol Stat* 2020; 27: 803–825.
39. Kahuthu A. Economic growth and environmental degradation in a global context. *Environ, Dev Sustain* 2006; 8: 55–68.
40. Shahbaz M, Mallick H, Mahalik MK, et al. Does globalization impede environmental quality in India?. *Ecol. Indic* 2015; 52: 379–393.
41. Dollar D and Kraay A. Trade, growth, and poverty. *Econ J* 2004; 114: F22–F49.
42. Leal PH and Marques AC. The environmental impacts of globalisation and corruption: evidence from a set of African countries. *Environ Sci Policy* 2021; 115: 116–124.
43. Shahbaz M, Topcu BA, Sarıgül SS, et al. The effect of financial development on renewable energy demand: the case of developing countries. *Renew. Energy* 2021; 178: 1370–1380.
44. Shahbaz M, Lahiani A, Abosedra S, et al. The role of globalization in energy consumption: a quantile cointegrating regression approach. *Energy Econ* 2018; 71: 161–170.
45. Shahbaz M, Van Hoang TH, Mahalik MK, et al. Energy consumption, financial development and economic growth in India: new evidence from a nonlinear and asymmetric analysis. *Energy Econ* 2017; 63: 199–212.
46. Rahman MM. Environmental degradation: The role of electricity consumption, economic growth and globalisation. *J. Environ. Manage* 2020; 253:109742.
47. Auty RM. The political economy of resource-driven growth. *Eur Econ Rev* 2001; 45: 839–846.
48. Bravo-Ortega C and De Gregorio J. The relative richness of the poor? Natural resources, human capital, and economic growth. *Natural Resources, Human Capital, and Economic Growth*; 2005: January.
49. Asif M, Khan KB, Anser MK, et al. Dynamic interaction between financial development and natural resources: Evaluating the 'Resource curse' hypothesis. *Resour. Policy* 2020; 65: 101566.
50. Brunnschweiler CN and Bulte EH. The resource curse revisited and revised: a tale of paradoxes and red herrings. *J Environ Econ Manage* 2008; 55: 248–264.
51. Pata UK and Isik C. Determinants of the load capacity factor in China: a novel dynamic ARDL approach for ecological footprint accounting. *Resour Policy* 2021; 74: 102313.
52. Wang KH, Liu L, Adebayo TS, et al. Fiscal decentralization, political stability and resources curse hypothesis: a case of fiscal decentralized economies. *Resour. Policy* 2021; 72: 102071.
53. Balsalobre-Lorente D, Shahbaz M, Roubaud D, et al. How economic growth, renewable electricity and natural resources contribute to CO2 emissions? *Energy Policy* 2018; 113: 356–367.
54. Baloch MA, Mahmood N and Zhang JW. Effect of natural resources, renewable energy and economic development on CO_2 emissions in BRICS countries. *Sci. Total Environ* 2019; 678: 632–638.
55. Pata UK, Aydin M and Haouas I. Are natural resources abundance and human development a solution for environmental pressure? Evidence from top ten countries with the largest ecological footprint. *Resour Policy* 2021; 70: 101923.
56. Farzin YH and Bond CA. Democracy and environmental quality. *J Dev Econ* 2006; 81(1): 213–235.

57. Shi A. The impact of population pressure on global carbon dioxide emissions, 1975–1996: evidence from pooled cross-country data. *Ecol Econ* 2003; 44(1): 29–42.
58. Fan Y, Liu LC, Wu G, et al. Analyzing impact factors of CO_2 emissions using the STIRPAT model. *Environ. Impact Assess. Rev* 2006; 26(4): 377–395.
59. Hassan K and Salim R. Population ageing, income growth and CO2 emission: empirical evidence from high income OECD countries. *J Econ Studies* 2015; 42: 54–67.
60. O'Neill BC, Dalton M, Fuchs R, et al. Global demographic trends and future carbon emissions. *Proc. Natl. Acad. Sci* 2010; 107(41): 17521–17526.
61. Menz T and Welsch H. Population aging and environmental preferences in OECD countries: the case of air pollution. *Ecol Econ* 2010; 69: 2582–2589.
62. Menz T and Welsch H. Population aging and carbon emissions in OECD countries: accounting for life-cycle and cohort effects. *Energy Econ* 2012; 34: 842–849.
63. Heijdra BJ, Kooiman JP and Ligthart JE. Environmental quality, the macroeconomy, and intergenerational distribution. *Resour Energy Econ* 2006; 28: 74–104.
64. Thalmann P. The public acceptance of green taxes: 2 million voters express their opinion. *Public Choice* 2004; 119(1): 179–217.
65. Gygli S, Haelg F, Potrafke N, et al. The KOF globalization indexerevisited. *Rev Int Organ* 2019; 14: 543–574.
66. Gyamfi BA, Adedoyin FF, Bein MA, et al. The anthropogenic consequences of energy consumption in E7 economies: juxtaposing roles of renewable, coal, nuclear, oil and gas energy: evidence from panel quantile method. *J Cleaner Prod* 2021a; 295: 126373.
67. Gyamfi BA, Bein MA, Udemba EN, et al. Investigating the pollution haven hypothesis in oil and non-oil sub-Saharan Africa countries: evidence from quantile regression technique. *Resour Policy* 2021b; 73: 102119.
68. Salehnia N, Alavijeh NK and Salehnia N. Testing Porter and pollution haven hypothesis via economic variables and CO 2 emissions: a cross-country review with panel quantile regression method. *Environ Sci Pollut Res* 2020; 27: 31527–31542.
69. Bouri E, Jalkh N and Roubaud D. Commodity volatility shocks and BRIC sovereign risk: a GARCH-quantile approach. *Resour Policy* 2019; 61: 385–392.
70. Binder M and Coad A. From average Joe's happiness to miserable Jane and cheerful John: using quantile regressions to analyze the full subjective well-being distribution. *J Econ Behav Organ* 2011; 79: 275–290.
71. Koenker R and Bassett GJr. Regression quantiles. *Econ: J Econ Soc* 1978; 33–50.
72. Powell JL. Least absolute deviations estimation for the censored regression model. *Rev* 1984; 34: 1089–1117.
73. Ismail S, Loganathan N, Streimikiene D, et al. Influencing factors mitigate Middle East tourist travelling to Malaysia: the quantile estimates. *J Int Studies* 2018; 11(2): 11–25.
74. Halliru AM, Loganathan N and Golam Hassan AA. Does FDI and economic growth harm environment? Evidence from selected West African countries. *Transnatl Corp Rev* 2020: 1–15.
75. Pesaran MH. Estimation and inference in large heterogeneous panels with a multifactor error structure. *Econometrica* 2006; 74: 967–1012.
76. Gyamfi BA, Bein MA and Bekun FV. Investigating the nexus between hydroelectricity energy, renewable energy, nonrenewable energy consumption on output: evidence from E7 countries. *Environ Sci Pollut Res* 2020a; 27: 25327–25339.
77. Pesaran MH. Testing weak cross-sectional dependence in large panels. *Econom* 2015; 6(4): 102–115.
78. Pesaran MH. A simple panel unit root test in the presence of cross-section dependence. *J Appl Econ* 2007; 22: 265–312.
79. Breusch TS and Pagan AR. The Lagrange multiplier test and its applications to model specification in econometrics. *Rev Econ Stud* 1980; 47: 239–253.
80. Hao LN, Umar M, Khan Z, et al. Green Growth and low carbon emission in G7 countries: how critical the network of environmental taxes, renewable energy and human capital is? *Sci Total Environ* 2021; 752: 141853.
81. Su C-W, Khan K, Tao R, et al. A review of resource curse burden on inflation in Venezuela. *Energy* 2020; 204: 117925.
82. Im KS, Pesaran MH and Shin Y. Testing for unit roots in heterogeneous panels. *J Econom* 2003; 115: 53–74.

83. Westerlund J. Testing for error correction in panel data. *Oxf Bull Econ Stat* 2007; 69: 709–748.
84. Waqih MAI, Bhutto NA, Ghumro NH, et al. Rising environmental degradation and impact of foreign direct investment: an empirical evidence from SAARC region. *J Environ Manag* 2019; 243: 472–480.
85. Gyamfi BA, Bein MA, Ozturk I, et al. The moderating role of employment in an environmental Kuznets curve framework revisited in G7 countries. *Indonesian J Sustain Account Management* 2020b; 4: 241–248.
86. Bekun FV, Alola AA, Gyamfi BA, et al. The environmental aspects of conventional and clean energy policy in sub-Saharan Africa: is N-shaped hypothesis valid? *Environ Sci Pollut Res* 2021; 28(47): 66695–66708.
87. Bekun FV, Alola AA, Gyamfi BA, et al. The relevance of EKC hypothesis in energy intensity real-output trade-off for sustainable environment in EU-27. *Environ Sci Pollut Res* 2021b: 1–12.
88. Hanif I, Raza SMF, Gago-de-Santos P, et al. Fossils fuels, foreign direct investment, and economic growth have triggered CO2 emissions in emerging asian economies: some empirical evidence. *Energy* 2019; 171: 493–501.
89. Destek MA and Sinha A. Renewable, non-renewable energy consumption, economic growth, trade openness and ecological footprint: evidence from organisation for economic Co-operation and development countries. *J Cleaner Prod* 2020; 242: 118537.
90. Hamza N and Gilroy R. The challenge to UK energy policy: an ageing population perspective on energy saving measures and consumption. *Energy Policy* 2011; 39: 782–789.
91. Rudolph A and Figge L. Determinants of ecological footprints: what is the role of globalization? *Ecol Indic* 2017; 81: 348–361.
92. Onifade ST, Gyamfi BA, Haouas I, et al. Re-examining the roles of economic globalization and natural resources consequences on environmental degradation in E7 economies: are human capital and urbanization essential components? *Resources Policy* 2021; 74: 102435.
93. Al-Mulali U and Tang FC. Investigating the validity of pollution haven hypothesis in the gulf cooperation council (GCC) countries. *Energy Policy* 2013; 60: 813–819.
94. Jia X, Klemeš JJ, Varbanov PS, et al. Analyzing the energy consumption, GHG emission, and cost of seawater desalination in China. *Energies* 2019; 12: 463. *Journal of Econometrics*, 25(3), 303–325.
95. Udemba EN and Agha CO. Abatement of pollutant emissions in Nigeria: a task before multinational corporations. *Environ Sci Pollut Res* 2020: 1–11.
96. Steve YS, Murad AB, Gyamfi BA, et al. Renewable energy consumption a panacea for sustainable economic growth: panel causality analysis for African blocs. *Int J Green Energy* 2021: 1–10.
97. Dumitrescu EI and Hurlin C. Testing for Granger non-causality in heterogeneous panels. *Econ Model* 2012; 29: 1450–1460

Bright Akwasi Gyamfi currently is a PhD candidate and scholar at Economic and Finance Application and Research Center, İstanbul Ticaret University. His research interest is in the area of Tourism economics, Energy economics, Sustainability and Agriculture economics. His work has appeared in journal such as *Environmental Science and Pollution*, Heliyon and more recently, *Journal of Cleaner Production and Energy and Environment*. He can be contacted via bagyamfi@ticaret.edu.tr

Tomiwa Sunday Adebayo was born in Lagos Nigeria in the late 1980s. He received his BTech in Management and Accounting (2011) from Ladoke Akintola University of Technology, Oyo state, Nigeria. He also received MA in International Finance (2017) from European University of Lefke, TRNC and MSc in Economics (2018) from Girne American University, Girne, TRNC. He is currently pursuing the PhD degree in Business Administration at Cyprus International University. He has published in renowned journals such as *Resource Policy, Sustainable Production and Consumption, Journal of Environmental Management, Renewable Energy, International Journal* *of Sustainable Development & World Ecology* and *Sustainable Development, and Sustainable, Environment, and Development*. His research interests include environmental economics, International Finance, and applied econometrics.

Festus Victor Bekun currently serves as an assistant professor at Istanbul Gelisim University Turkey and also senior research fellow at South Ural State University Russia. His research interest is in the areas of agricultural economics, energy economics and sustainability, and tourism economics. His works have appeared in top-tier journals including *Science of The Total Environment, Energy & Environment, Journal of Cleaner Production*, more recently *Current Issues in Tourism* and Heliyon, among others. He is currently working on oil price spillover volatility on selected agricultural commodity prices and energy market dynamics. He can be contacted via this Email: fbekun@gelisim.edu.tr

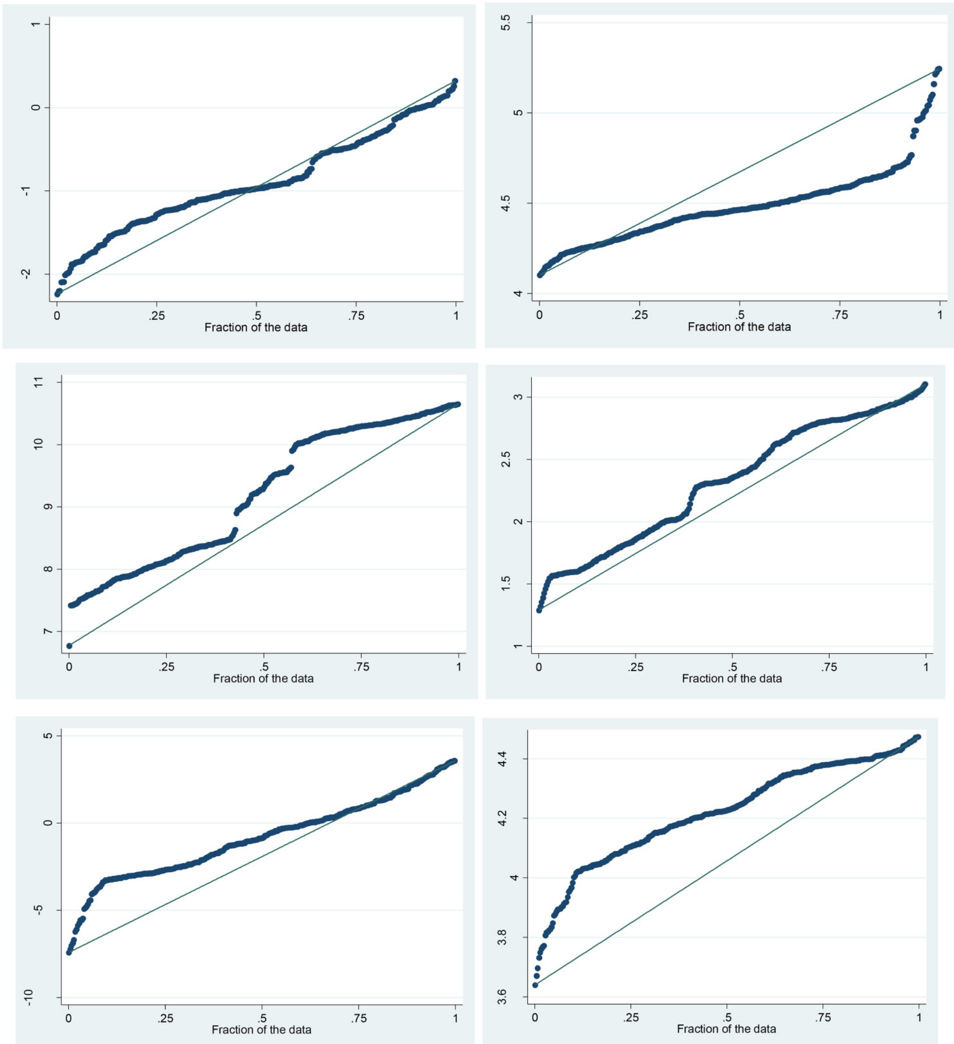
Mary Oluwatoyin Agboola is currently an assistant professor at the College of Business Dar Al Uloom University, Riyadh Saudi Arabia. Her Research interest is focused on Food security, Poverty and Developmental issues, Macro Economics and Energy Economics.

Appendix 1

Appendix Table 1. List of countries.

Albania	Greece
Algeria	Israel
Bosnia	Morocco
Croatia	Turkey
Cyprus	Tunisia
Arab Republic of Egypt	Spain
France	Italy

Source: Authors' computation.



Appendix Figure 1. Pattern of quantile regression on the variables for Mediterranean countries from 1995 to 2016.