HOW DO ENVIRONMENTAL PROTECTION EXPENDITURES AFFECT HEALTH STATUS? EVIDENCE FROM PANEL QUANTILE REGRESSION[1]

Kafkas University
Economics and Administrative
Sciences Faculty
KAUJEASF
Vol. 13, Issue 26, 2022
ISSN: 1309 – 4289
E – ISSN: 2149-9136

Article Submission Date: 10.10.2022 *Accepted Date: 09.12.2022*

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ABSTRACT | The relationship between environment and health status has attracted intensive attention in recent years. However, limited studies have focused on environmental protection expenditure on health status. This study empirically tests the links of environmental protection expenditure with health status for 20 European countries over the period 1995-2019. For empirical analysis, this study utilized panel quantile regression. The empirical results show that while environmental protection expenditure, GDP, and education help to ameliorate health status, CO_2 emissions worse health status. Hence, efficient environmental protection expenditure and environmental policies must align with strategies to improve health status.

Keywords: *Environmental protection expenditure, CO_2 emissions, Health status, Panel quantile regression*
JEL Codes: *C23, I10, Q53*

Scope: *Economics*
Type: *Research*

DOI: 10.36543/kauiibfd.2022.043

Cite this article: Barak, D. & Tunc, A. (2022). How do environmental protection expenditures affect health status? Evidence from panel quantile regression. *KAÜİİBFD, 13*(26), 1036-1068.

[1] It has been declared that the relevant study complies with the ethical rules.

ÇEVRE KORUMA HARCAMALARI SAĞLIK DURUMUNU NASIL ETKİLER? PANEL KANTİL REGRESYONUNDAN KANITLAR

Kafkas Üniversitesi
İktisadi ve İdari Bilimler Fakültesi
KAÜİİBFD
Cilt, 13, Sayı 26, 2022
ISSN: 1309 – 4289
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Makale Gönderim Tarihi:10.10.2022 *Yayına Kabul Tarihi: 09.12.2022*

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ÖZ | Çevre ve sağlık durumu arasındaki ilişki son yıllarda yoğun ilgi görmektedir. Bununla birlikte, sınırlı sayıda çalışma, sağlık durumuna yönelik çevre koruma harcamalarına odaklanmıştır. Bu çalışma, 1995-2019 dönemi boyunca 20 Avrupa ülkesi için çevre koruma harcamalarının sağlık durumuyla olan bağlantılarını ampirik olarak test etmektedir. Ampirik analiz için bu çalışmada panel kantil regresyon kullanılmıştır. Ampirik sonuçlar, çevre koruma harcamaları, GSYİH ve eğitimin sağlık durumunu iyileştirmeye yardımcı olurken, CO_2 emisyonlarının sağlık durumunu kötüleştirdiğini göstermektedir. Bu nedenle, verimli çevre koruma harcamaları ve çevre politikaları, sağlık durumunu iyileştirmeye yönelik stratejilerle uyumlu olmalıdır.

Anahtar Kelimeler: *Çevre koruma harcamaları, CO_2 emisyonları, Sağlık durumu, Panel kantil regresyon*
JEL Kodları*: C23, I10, Q53*

Alan: *İktisat*
Türü: *Araştırma*

1. INTRODUCTION

The main reason of global warming and climate change is CO_2 emissions (Danish, Zhang Wang & Wang, 2017; Sarkodie, Strezov, Weldekidan, Asamoah, Owusu & Doyi, 2019; Koçak, Ulucak & Ulucak, 2020). CO_2 emissions rise from 11,192 million tons (1965) to 33,884 million tons (2021) worldwide (BP, 2021). It is a known fact that human activities pose a risk to the environment (Mahmoud & Gan, 2018; Manisalidis et al., 2020). On the other hand, CO_2 emissions have an adverse effect on human health (Chaabouni, Zghidi, & Mbarek, 2016). Environmental degradation is viewed as a global public health issue (OECD, 2001; Manisalidis et al., 2020) and affects environmental conditions and social infrastructure, as well as the health and well-being of people (World Health Organization, WHO, 2017). The environment can affect human health and well-being in two ways. First, a high-quality environment provides clean air and water and sufficient supplies of energy and raw materials for industrial production. Second, a poor-quality environment exposes people to polluted air, noise and hazardous chemicals (European Environment Agency, EEA, 2022). The adverse conditions created by environmental pollution cause great problems for health and country's budget. Climate change is predicted to result in an additional 250.000 fatalities annually between 2030 and 2050, just from starvation, malaria, diarrhea, and heat stress. By 2030, the direct health costs are projected to be between USD 2-4 billion annually (WHO, 2022). Individuals who want to maximize their utility are faced with a choice problem. People with a high preference for living in a clean environment may prefer to live in areas with higher environmental quality (Neidell, 2004).

According to Altıntaş and Kassouri (2020), as European Union (EU) economy has expanded rapidly, ecological environmental problems (air pollution, wastewater treatment) still face persistent. In a recent study, Juginović, et al. (2021) estimated that approximately 368.006 people died in Europe in 2019 due to air pollution. To overcome these environmental problems and improve their health status, European countries have implemented various policies (EEA, 2020; EEA, 2021). These are; i) Approved the Clean Air Quality Package proposal in 2013, ii) A key governance instrument with a 2050 vision identified by the Seventh Environmental Action Program (7th EAP) to direct environmental policies throughout the EU, iii) The EU's environmental policies for the years 2021-2030 guided politically by the eighth environment action program (8th EAP), iv) With the Zero Pollution Action Plan, it is aimed to reduce the number of premature deaths due to fine particulate matter by 55% by 2030. The UK hosted COP26, held in Glasgow (Smith, et al., 2022). The first of the four main goals set in COP26 is to reduce global emissions by 45% by 2030. Thus, climate change has become not a minor issue but a life-threatening global emergency (Arora & Mishra, 2021).

Since the pioneering theoretical and empirical work by Grossman (1972), it has been recognized that health outcomes are influenced by social, economic, and environmental ingredients (Fayissa & Gutema, 2008; Azam, Uddin & Saqib, 2022). After Grossman's work, various studies investigated the determinants of health status. For example, Cropper (1981) and Gerking and Stanley (1986) modified and improved Grossman's health production function model (Lu et al., 2017). After these studies, social, economic, environmental and policy factors that determine health status were examined in the literature (Klomp & De Haan, 2008; Asemane, Emamgholipour & Rshidian, 2015; Nicholas, Edward & Bernardin, 2016; Kafili & Ghasemzade, 2019; Osakede, 2020; Ojo Olusoji et al., 2020; Alimi & Ajide, 2021; Doucouliagos, Hennessy & Mallick, 2021; Owumı & Alfred, 2021; Ibukun, 2021). Most of the studies in the literature have concluded that environmental pollution negatively affects health status (Sirag et al., 2017; Matthew et al., 2018; Majeed & Khan, 2019; Hossain et al., 2020; Shobande, 2020; Rahman & Alam, 2021; Chen et al., 2021; Rahman & Alam, 2022a; Azam et al., 2022; Omri, et al., 2022). On the contrary, some of the previous studies concluded that environmental protection expenditure improved environmental quality (Farzanegan & Mennel, 2012; Bostan et al., 2016; He et al., 2018; Huang, 2018; Basoglu & Uzar, 2019). Environmental degradation both negatively affects the quality of life of society and increases health expenditures (Balan, 2016). Therefore, a cleaner environment will provide a better environment for human health. It is possible to slow the growth of healthcare costs by increasing expenditure on environmental preservation.

As economies grow, the demand for a more livable environment increases and new technologies emerge that make human life easier. On the other hand, as economies grow, environmental pollution, which is the result of urbanization, industrialization, and energy consumption, creates a threat to the environment. The most typical metric for assessing the health of a population is life expectancy (LE). Based on current age and sex-specific death rates, it estimates how long a person is likely to live (Ortiz-Ospina, 2019). The amount of money spent on preventing, reducing, and eliminating pollution to minimize the negative influence of human activities on the environment is known as environmental protection expenditure (EPE) (Broniewicz, 2011; OECD, 2022). The main purpose of EPE made by the public and private sectors is to protect the environment by eliminating the elements that may harm the environment and to increase the environmental quality for this purpose (Krajewski, 2016; He et al., 2018; Basoglu & Uzar, 2019). Environment and humans are elements that are interconnected to form a unity. Just as the environment is necessary for human existence, the environment is also necessary for the future of humanity. Therefore, increasing the expenditure that will improve the environmental quality will positively affect life expectancy since it will result in a cleaner environment (Alimi & Ajide, 2021).

The determinants of health status have been extensively analyzed in the health economics and policy literature; however, the role of EPE in health status remains unexplored. Therefore, this paper intends to make a contribution to the debate on the effects of EPE on health status by focusing on European countries. The hypotheses of this article are formed as follows:

H_1: What is the association between LE and EPE in 20 European countries?
H_2: What is the association between LE and CO_2 emissions in these countries?
H_3: What is the association between LE and GDP per capita in these countries?
H_4: What is the association between LE and education in these countries?

After the introduction of the study, the literature examining the environment-health relationship is discussed. After the data set and related methodology are explained, the findings are discussed and compared with other studies in the literature. In the conclusion section, policy implications are given.

2. LITERATURE

There are various socioeconomic, political, environmental and healthcare factors that affect health status in the literature (Klomp & De Haan, 2008; Yaqub, Ojapinwa & Yussuff, 2012; Farag et al., 2013; Nicholas et al., 2016; Rahman, Khanam & Rahman, 2018; Al-Azri, Al-Mamari & Mondal, 2020; Osakede, 2020; Tatli & Brarak, 2021; Doucouliagos et al., 2021; Chen et al., 2021; Alimi & Ajide, 2021). Recently, examining the nexus between the environment and health has become important in the literature. This study investigates the role of the environment on health status. To this end, the literature section specifically focuses on the environment-health nexus. Table 1 provides a summary of these studies.

Table 1: The Literature on the nexus between the Environment and Health

Author(s)	Country	Period	Methodology
Mutizwa and Makochekanwa (2015)	12 SADC Countries	2000-2008	FE, RE
Balan (2016)	European countries	1995-2013	DH panel non-causality test, Panel OLS
Ecevit and Çetin (2016)	Turkiye	1960-2011	Johansen-Juselius cointegration, FMOLS, DOLS, GC
Sirag et al. (2017)	35 Sub-Saharan African countries	1995–2012	Pedroni panel cointegration, FMOLS, DOLS
Matthew et al. (2018)	Nigeria	1985-2016	ARDL
Majeed and Khan (2019)	184 countries	1990-2014	2SLS, system GMM
Nkalu and Edeme (2019)	Nigeria	1960-2017	GARCH
Erdoğan, Yıldırım and Gedikli (2019)	Turkiye	1971-2016	Johansen Cointegration, DOLS
Hossain et al. (2020)	Bangladesh	1974-2014	ARDL
Onofrei et al. (2020)	11 European developing countries	2000-2017	OLS, FE, RE
Shobande (2020)	23 African countries	1999-2014	pooled OLS and system GMM
Majeed and Ozturk (2020)	180 countries from	1990-2016	OLS, FE, RE, system GMM
Akter, Tasnime and Uddin (2020)	South Asian countries	1983-2016	Pooled OLS, Quantile Regression
Wang et al. (2020a)	Pakistan	1972-2017	ARDL, VECM
Rahman and Alam (2021)	SAARC-BIMSTEC region	2002–2017	Pedroni and Kao panel cointegration, Panel ARDL, DH panel causality
Rahman, Alam and Velayutham (2021)	Most industrialised countries	1960-2019	DK standard error, PCSE
Rodriguez-Alvarez (2021)	29 European countries	2005-2018	Stochastic frontier approach
Anser et al. (2021)	39 countries	2021	Switching regression method, variance decomposition analysis
Sheng, Wan and Wang (2021)	China	2007-2019	Spillover effect analyses
Murthy et al. (2021)	D-8 countries	1992-2017	Panel ARDL
Alimi and Ajide (2021)	Sub-Saharan Africa	1996-2016	System GMM
Majeed, Luni and Zaka (2021)	155 countries	1990-2018	2SLS, GMM

Ibrahim, Ajide and Omokanmi (2021)	Sub-Saharan Africa	1990-2019	System GMM, FE OLS
Chen et al. (2021)	10 developing countries and 10 developed countries	2004-2016	Multiple Linear Regression Models
Bouchoucha (2021)	17 MENA countries	1996-2018	FMOLS, DOLS
Rjoub et al. (2021)	Turkiye	1960-2018	Bayer-Hanck cointegration test and wavelet coherence.
Ibrahim and Ajide (2021)	Algeria, Egypt, Libya and Nigeria	1990-2017	Kao residual cointegration test, FMOLS
Alharthi and Hanif (2021)	Developing Asian countries	1995-2018	Panel ARDL
Ecevit, Çetin and Yücel (2022)	Turkiye	1988-2018	ARDL, FMOLS, DOLS, CCR, VECM GC
Azam et al. (2022)	Pakistan	1975-2020	ARDL, Johansen cointegration, GC
Omri et al. (2022)	Saudi Arabia	2000-2018	Johansen cointegration, DOLS, FMOLS
Yu et al. (2022)	Brazil	210-2018	Quasi-Poisson regression
Tsai, Chen and Yang (2022)	Taiwan	2000-2020	Linear regression
Rahman, Alam and Khanam (2022b)	African countries	2000-2018	PCSE, FGLS, GC
Arafat et al. (2022)	Pakistan	1965-2019	ARDL, DOLS, Johansen Cointegration, VECM
Mahalik et al. (2022)	68 developing and emerging economies	1990-2017	PCSE, DK Standard Error, FGLS
Radmehr and Adebayo (2022)	10 Mediterranean countries	2000-2018	Westerlund (2007) cointegration, FMOLS, DOLS, FE-OLS, Method of moments quantile regression
Bunyaminu et al. (2022)	43 African countries	2000-2018	GMM
Salehnia, Karimi Alavijeh and Hamidi (2022)	100 countries	2000-2018	Panel quantile regression
Hendrawaty et al. (2022)	ASEAN	1988-2018	Panel ARDL
Ibrahim (2022)	Africa	1980-2019	Westerlund (2007) cointegration, CCEMG, AMG, CS-ARDL, Quantile regression, DH panel causality test
Rahman and Alam (2022a)	ANZUS-BENELUX countries	1996-2019	DK standard error, FGLS, DH panel causality test
Rahman and Alam (2022b)	Australia	1990-2018	ARDL, FMOLS, GC

Bayar et al. (2022)	EU transition states	2000-2017	Westerlund and Edgerton (2008) cointegration test with structural breaks, AMG, DH panel causality test
Barua et al. (2022)	42 countries in Asia and the Pacific	2005-2015	PSCC, LSDV, system GMM
Sial et al. (2022)	15 Asian economies	1996-2019	FGLS

The literature in Table 1 might be classified as follows:

i) There is a consensus in the literature that environmental degradation rises infant mortality (Ecevit & Çetin, 2016; Majeed & Khan, 2019; Erdoğan et al., 2019; Shobande, 2020; Majeed & Ozturk, 2020; Omri et al., 2022; Yu et al., 2022; Tsai et al., 2022; Barua et al., 2022) and reduces life expectancy (Balan, 2016; Sirag et al., 2017; Matthew et al., 2018; Nkalu & Edeme, 2019; Erdoğan et al., 2019; Majeed & Khan, 2019; Majeed & Ozturk, 2020; Akter et al., 2020; Hossain et al., 2020; Rahman and Alam, 2021; Rodriguez-Alvarez, 2021; Murthy et al., 2021; Alimi & Ajide, 2021; Ibrahim et al., 2021; Chen et al., 2021; Bouchoucha, 2021; Rjoub et al., 2021; Azam et al., 2022; Omri et al., 2022; Rahman & Alam, 2022a; Arafat et al., 2022; Radmehr & Adebayo, 2022; Salehnia et al., 2022; Ibrahim, 2022; Bayar et al., 2022). Also, Mutizwa and Makochekanwa (2015) concluded that environmental degradation does not have an impact on infant mortality. Rahman et al. (2021), Alharthi and Hanif (2021), and Ibrahim et al. (2021) found that environmental degradation rises the mortality rate.

ii) It can be said that there are very few studies dealing with the association between EPE and health status. From these studies, Onofrei et al. (2020) revealed a strong positive association between EPE and health status. Sheng et al. (2021) concluded that raising EPE can reduce the rate of escalating medical and healthcare costs.

iii) The results provided by the literature reveal that economic growth improves health status (Sirag et al., 2017; Rahman et al., 2021; Majeed et al., 2021; Bouchoucha, 2021; Rahman & Alam, 2022b; Wang et al., 2020a; Azam et al., 2022; Rahman et al., 2022b; Bunyaminu et al., 2022; Hendrawaty et al., 2022; Sial et al., 2022). On the other hand, Ecevit et al. (2022) indicate that economic growth negatively affects health outcomes in Turkey.

iv) Conclusions from the literature suggest that overall better education is associated with better health status (Sirag et al., 2017; Shobande, 2020; Rahman & Alam, 2022b; Rahman et al., 2021; Majeed et al., 2021; Azam et al., 2022; Rahman & Alam, 2022b; Bunyaminu et al., 2022; Sial et al., 2022).

3. DATA AND METHODOLOGY

3.1. Data

To determine the influence of EPE, CO_2 emissions, education and per capita income on LE, this study utilizes the following model that is in line with the existing literature (Onofrei et al., 2020; Sheng et al., 2021; Rahman & Alam, 2021; Alimi & Ajide, 2021; Omri et al., 2022):

$$LEXP_{it} = \beta_0 + \beta_1 EPE_{it} + \beta_2 CO2_{it} + \beta_3 GDP_{it} + \beta_4 EDU_{it} + \varepsilon_{it} \qquad (1)$$

where *i* denotes the country index and *t* represents the time index in the panel of countries, ε represents error term, and *LEXP* denotes life expectancy at birth (total, years). *LEXP* is employed as a proxy for health status. *EPE* represents environmental protection expenditure (percent of GDP), and CO_2 denotes carbon dioxide emissions measured in million tons per capita. CO_2 is employed as a proxy for environmental degradation. CO_2 emissions directly affect human health (Wang, Huang & Chen, 2019). Therefore, CO_2 emissions have a harmful effect on human health (Bernstein, Alexis, Barnes, Bernstein, Nel, Peden, Diaz-Sanchez, Tarlo & Williams, 2004; Haseeb, Kot, Hussain & Jermsittiparsert, 2019). *GDP* signifies GDP per capita (in dollars at the 2015 constant price); *EDU* represents expected years of schooling (years), $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ represent parameters to be estimated. The natural logarithm of all variables is taken before conducting the analysis. The annual data spans from 1995 to 2019 for 20 European countries. These 20 countries are "Austria, Belgium, Croatia, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweeden, Switzerland and United Kingdom". The LE and GDP per capita data are obtained from the World Bank's World Development Indicators (World Bank, 2022), the data on EPE is downloaded from International Monetary Fund (IMF, 2021), and CO_2 emissions are obtained from the British Petrol Statistical Review of World Energy (BP, 2021) and education sourced from the United Nations Development Programme (UNDP, 2020).

Since our prior objective is to examine whether EPE has an influence on LE, the dependent and independent variables are LE and EPE, respectively, and CO_2 emissions, GDP per capita and education are included in the model as control variables. Descriptive statistics are presented in Table 2. The sample selection in this study has good representativeness, as these 20 European countries have similar characteristics.

Table 2: Descriptive Statistics

	LEXP	EPE	CO2	GDP	EDU
Mean	4.368	-0.372	-11.765	10.322	2.780
Median	4.370	-0.370	-11.766	10.489	2.778
Maximum	4.427	0.576	-11.101	11.389	2.985
Minimum	4.275	-1.647	-12.630	8.637	2.424
Std. Dev.	0.033	0.396	0.323	0.609	0.099
Skewness	-0.579	-0.228	-0.077	-0.606	-0.509
Kurtosis	2.7670	3.391	2.362	2.634	3.772
Jarque-Bera	29.080	7.560	8.966	33.469	34.064
Probability	0.000	0.022	0.011	0.000	0.000
Sum	2184.033	-186.206	-5882.49	5161.240	1390.117
Sum Sq. Dev.	0.567	78.303	52.325	185.270	4.969
Observations	500	500	500	500	500

The relationship between LEXP, EPE, CO_2, GDP per capita and education in 20 European countries is examined in four steps. First, we test the stationary properties of these series by employing the CIPS unit root test. Second, the long-run relationship between the series is analyzed using the Durbin-Hausman cointegration test. Third, assuming that the series are cointegrated, the long-run coefficients for EPE, CO_2 emissions, per capita income and education are estimated. Finally, we test the potential causation between the series by employing the Dumitrescu Hurlin causality test.

3.2. Cross-Section Dependence

Economic, trade, social and political links between European countries might have generated a long-term convergence between these countries. If countries are tie-ups in trade and socio-political fields, economic shocks in one country might affect others (Sharma et al., 2022). Disregarding the cross-section dependency in panel data analysis may create estimation problems in econometric analysis such as prediction of spurious regression estimates, biased stationarity and cointegrating features (Bhat, 2018; Li et al., 2021). Hence, one must first determine if there is a cross-sectional dependency before delving into the stationarity features of the series (Sheraz et al., 2021). Cross-sectional dependency tests are employed under the null of there is no cross-section dependency. For this reason, a cross-section dependency test was applied in order to obtain consistent results and to decide which of the first-generation and second-generation unit root tests to be used. Apart from the cross-sectional dependence, another important issue that needs to be tested is slope homogeneity. Ignoring the slope heterogeneity could result in the estimations being biased (Murshed, Haseeb & Alam, 2021). To this end, we employ delta slope heterogeneity tests proposed by Pesaran and Yamagata (2008). For the slope homogeneity test, the null hypothesis is that there is no slope homogeneity. Cross-sectional dependence (CD) and slope homogeneity play an important role in determining the appropriate unit root and cointegration tests (Ntarmah et al., 2022).

3.3. Panel Unit Root Tests

In order to decide on the appropriate estimation technique, it is necessary to test the stationarity characteristics of the series (Dogan & Inglesi-Lotz, 2020). In the existence of cross-sectional dependence, results of first-generation panel unit root tests (LLC, IPS) produce misleading outputs and biased estimators (Saqib & Benhmad, 2021; Boukhelkhal, 2021). CIPS panel unit root test based on the notions of cross-sectional dependence and heterogeneity in the series produces a more reliable outcome (Raza, Shah & Khan, 2020). Therefore, this study used "the second-generation cross-sectionally augmented Im-Pesaran-Shin (CIPS) test" proposed by Pesaran (2007).

3.4. Cointegration

The Durbin-Hausman (DH) cointegration test, proposed by Westerlund (2008), was used to investigate the potential long-run relationships between variables. The DH test produces two statistics. In the DHp statistic, the autoregressive parameter is considered to have a common value, whereas, in the DHg statistic, autoregressive parameters are assumed to be heterogeneous. This test has several advantages (Ulucak, Yücel & İlkay, 2020; Ulucak & Yucel, 2021); (i) it takes into account the cross-sectional dependence; (ii) it may be used with a large number of independent variables; (iii) it is widely preferred for modeling cointegration between variables with a mixed order of integration.

3.5. Panel Estimation Techniques

"Fully modified ordinary least squares" (FMOLS) and "Dynamic ordinary least squares" (DOLS) proposed by Pedroni (2001) and the technique presented by Driscoll and Kraay (DK) (1998) can be employed to examine the long-run relationships. FMOLS and DOLS estimators have several advantages (Dogan & Seker, 2016; Zhang, Wang & Latif, 2019; Kumar et al., 2021; Merlin & Chen, 2021); (i) these two estimators could help to overcome the problem of autocorrelation and endogeneity, (ii) FMOLS uses non-parametric modeling to eliminate problems of endogeneity and autocorrelation. However, DOLS uses parametric modeling to help counteract these through lags and leads of the explanatory variables, (iii) DOLS technique is the best one in case of cross-sectional dependence and heterogeneity in data, (iv) FMOLS estimator gives reliable estimate results in small samples, (v) however, these two estimators can not solve the problem of autocorrelation between panel units. Estimation results may be ineffective if this issue is ignored. For this reason, the DK method, which allows for dependencies between panel units and solves the variable variance problem (Bui, et al., 2021), is also used. DK method; (i) addresses the problem of heteroscedasticity, autocorrelation and cross-sectional dependence among the groups in the panel. ii) It uses a non-parametric method that allows flexibility and a large time dimension. iii) It is the most effective method in case of missing values in the data series. iv) Useful for both balanced and unbalanced panels. v) The run takes the absolute value of all negative values to avoid missing data after logarithmic transformation (Sarkodie & Strezov, 2019; Baloch et al., 2020a, 2020b, Yasmeen et al., 2021).

3.6. Quantile Regression

This study employed a panel fixed-effect quantile regression proposed by Koenker (2004) for the robustness check. This model is based on Koenker and Bassett (1978) seminal work on quantile regression (Awan et al., 2022; Banday & Kocoglu, 2022).

The most important advantage of panel quantile regression (PQR), unlike traditional regression approaches, is to catch and eliminate outliers between expected and observed variables related to the inaccuracy of prediction coefficients (Anwar et al., 2021; Akbar et al., 2022; Hussain and Sattar, 2022). Because the PQR focuses on average effects (Anwar et al., 2021; Banday & Kocoglu, 2022). Also, the PQR outperforms the ordinary least squares (OLS) approach when error terms are not normally distributed (Amin, Jamasb & Nepal, 2020; Xie, Wu & Wang, 2021; Wei & Ullah, 2022). This model is used when the explanatory variables exhibit different impacts over the conditional distribution of the dependent variable (Alharthi, Dogan & Taskin, 2021; Bilgili et al., 2022).

The fixed effect PQR model can be stated as (Cheng, Ren, Wang & Yan, 2019; Akram et al., 2020; Akram et al., 2021);

$$Q_{LEXP_{it}}(\tau|X_{it}) = \beta(\tau)'X_{it} + \alpha_i \qquad i = 1,\ldots,N,\ t = 1,\ldots,T \tag{2}$$

Here $LEXP_{it}$ is the dependent variable, life expectancy at birth, $Q_{LEXP_{it}}(\tau|X_{it})$ represent τt quantile of life expectancy, X_{it} denotes the independent variables (EPE, CO_2, GDP, EDU), $\beta(\tau)$ refers to the vector of unknown coefficients, α_i indicates the unobserved individual effects. *i* denotes the European countries, *t* denotes the time. The model in our study is as follows:

$$Q_{LEXP_{it}}(\tau|X_{it}) = \beta_{1\tau}EPE_{it} + \beta_{2\tau}CO2_{it} + \beta_{3\tau}GDP_{it} + \beta_{4\tau}EDU_{it} + \alpha_i \tag{3}$$

The main problem with the estimation model (3) is that conventional linear methods are not suitable for estimating the quantile regression model. In order to overcome this problem, Koenker (2004) has proposed a penalty term which can eliminate unknown fixed effects. Compared to alternative methods, this method has some advantages in two ways; (i) It can efficiently reduce the estimated parameters; (ii) It can limit the variability introduced by a large number of calculated individual coefficients. Following Koenker (2004), our study estimates Eq (3) in this way:

$$argmin \sum_{k=1}^{K} \sum_{i=1}^{N} \sum_{t=1}^{T} \omega_k \rho_{\tau k}$$

$$[LEXP_{it} - \beta_{1\tau} EPE_{it} - \beta_{2\tau} CO2_{it} - \beta_{3\tau} GDP_{it} - \beta_{4\tau} EDU_{it} - \alpha_i] + \mu \sum_{i=1}^{N} |\alpha_i| \quad (4)$$

where $\rho_\tau(y) = y(\tau - 1_{y<0})$ is a standard check function, 1_A represents the indicator function of set A. $LEXP_{it}$, indicates the life expectancy at birth. K is the index for quantiles, and ω_k is the weight of the *k-th* quantile to control the position of different quantiles. μ is the parameter to control the individual effect (Cheng et al., 2019; Akram et al., 2020; Akram et al., 2021).

3.7. Causality Analysis

The FMOLS, DOLS and DK estimators do not give information about the causation linkages. For this reason, we used the DH panel causality test developed by Dumitrescu and Hurlin (2012) to test the causality between LEXP, EPE, CO_2 emissions, GDP per capita and education. The DH test does not ignore the problem of cross-sectional dependence and heterogeneity (Wang, et al., 2020b; Iqbal, Tang, & Rasool, 2022). Also, this method is applied to cases where T>N or T<N as well as unbalanced panels (Amin et al., 2021; Assi, Isiksal & Tursoy, 2021). The null hypothesis is that there is no causation in the panel against the alternative that there exists a causal relationship in at least one cross-section unit.

4. RESULTS AND DISCUSSION

4.1. Cross-Section Dependence

The result of the cross-section dependence tests is provided in Table 3. The empirical estimates showed that the null hypothesis of cross-sectional independence in the LE, EPE, GDP per capita and education are rejected. This result implied that there is cross-sectional dependence between all variables. In addition, the results of the slope heterogeneity test are displayed in Table 3. The slope heterogeneity test shows that the null of slope homogeneity is rejected. Since the null hypothesis of cross-section independence is rejected for all tests, it can be said that there is a high dependency among European countries. On the other hand, the existence of slope heterogeneity reveals that these countries have different policy designs and instruments due to the differences in their economic structures.

Table 3: Results of the Cross-Section Dependence Test

	LM (Breusch, Pagan 1980)	CD_{LM} (Pesaran 2004)	CD (Pesaran 2004)	LM_{Adj} (PUY, 2008)
		constant		
LEXP	298.892[a] (0.000)	5.586[a] (0.000)	-2.891[a] (0.002)	1.672[b] (0.047)
EPE	338.430[a] (0.000)	7.614[a] (0.000)	-1.471[c] (0.071)	-3.125 (0.999)
CO2	296.277[a] (0.000)	5.452[a] (0.000)	-2.374[a] (0.009)	5.454[a] (0.000)
GDP	299.820[a] (0.000)	5.634[a] (0.000)	0.100 (0.460)	1.346[c] (0.089)
EDU	368.801[a] (0.000)	9.172[a] (0.000)	-2.917[a] (0.002)	8.621[a] (0.000)
		constant and trend		
LEXP	337.587[a] (0.000)	7.571[a] (0.000)	-2.635[a] (0.004)	2.294[b] (0.011)
EPE	308.840[a] (0.000)	6.096[a] (0.000)	-2.239[b] (0.013)	2.006[b] (0.022)
CO2	316.840[a] (0.000)	6.507[a] (0.000)	-2.237[b] (0.013)	1.449[c] (0.074)
GDP	311.857[a] (0.000)	6.251[a] (0.000)	0.552 (0.291)	1.875[b] (0.030)
EDU	357.906[a] (0.000)	8.613[a] (0.000)	-2.771[a] (0.003)	8.545[a] (0.000)
Testing for slope heterogeneity				
	Statistic		p-value	
Delta	18.282[a]		0.000	
Adj. Delta	20.440[a]		0.000	
Note: a, b and c refer to significance levels at %1, %5 and %10. The value in parentheses is p value.				

4.2. Panel Unit Root Tests

The results of the cross-sectional dependence test indicate that all series are cross-sectionally dependent. For this reason, the stationarity properties of the variables are examined with the second-generation unit root test (CIPS) developed by Pesaran (2007), which gives accurate results under cross-section dependence. The results of the CIPS are reported in Table 4. The result revealed that series include unit root at level. In other words, all variables are stationary at their first differenced form.

Table 4: Result of Panel Unit Root Test

Variables	*Level*		*Difference*	
	constant	*constant and trend*	*constant*	*constant and trend*
LEXP	-2.048	-2.179	-2.878[a]	-2.852[b]
EPE	-1.994	-2.233	-3.555[a]	-3.672[a]
CO2	-2.291[b]	-2.553	-3.566[a]	-3.393[a]
GDP	-1.962	-1.993	-3.022[a]	-3.213[a]
EDU	-1.821	-2.035	-3.921[a]	-4.331[a]
Critical Values	*constant*		*constant and trend*	
%1	-2.38		-2.88	
%5	-2.20		-2.72	
%10	-2.11		-2.63	
Note: a, b and c refer to significance levels at %1, %5 and %10				

4.3. Cointegration

Table 5 shows the DH test results. The results (DH_Group and DH_Panel) reveal the long-run relationship between LE, EPE, CO_2 emissions, GDP per capita and education.

Table 5: Result of the Cointegration Test

	Statistic	p-value
constant		
DH_g	7933.291[a]	0.000
DH_p	48.830[a]	0.000
constant and trend		
DH_g	193.852[a]	0.000
DH_p	121.392[a]	0.000
Note: a refers to significance level at %1		

4.4. Panel Estimation Techniques

To examine the effect of EPE, environmental degradation, GDP per capita and education on health status, FE-OLS, DOLS, FMOLS estimators and DK techniques are applied in the study. The results of these tests are given in Table 6. According to the results of FE-OLS, DOLS, FMOLS and DK, a rise in EPE improves health status. Regarding EPE, empirical estimations indicate that EPE has beneficial impacts on LE. In other words, EPE contributes to health status in European countries. The positive connection of EPE with health status is in line with the study by Onofrei et al. (2020).

On the other hand, a percentage rise in environmental degradation tends to worsen health status, revealing the adverse impact of environmental degradation on health status. This finding is in line with the results of Majeed and Ozturk (2020) for panel data of 180 countries, Mahalik et al. (2022) for 68 low- and middle-income countries, Rahman, et al. (2022a) for the world's most polluted countries.

A rise in GDP per capita contributes to LE. Our estimated positive effects of GDP per capita on health status are also in line with the studies by Wang et al. (2020a) for Pakistan for the period 1972-2017, Rahman and Alam (2021) for ten countries for the 2002-2017 period, Chen et al. (2021) for 20 developed and developing countries from 2004 to 2016, Salehnia et al. (2022) for 100 countries for the period 2000-2018.

The significant result of the elasticity of education indicates that a rise in education is expected to rise health status. The positive association of education with health status is in line with the previous studies by Majeed and Khan (2019) for 184 countries in the 1990-2014 period, Chireshe and Ocran (2020) for 45 sub-Saharan African countries.

Table 6: Long Run Coefficient

Variables	FE-OLS	FMOLS	DOLS	DK regression estimator	DK regression estimator with fixed effect
EPE	0.010[a] (4.59)	0.011[a] (3.33)	0.010[a] (2.65)	0.012[a] (10.56)	0.010[a] (3.52)
CO2	-0.059[a] (-15.91)	-0.058[a] (-10.37)	-0.039[a] (-5.13)	-0.043[a] (-18.68)	-0.059[a] (-8.20)
GDP	0.082[a] (18.88)	0.078[a] (11.89)	0.025[a] (2.95)	0.028[a] (13.70)	0.082[a] (11.61)
EDU	0.088[a] (8.47)	0.092[a] (5.77)	0.154[a] (8.63)	0.169[a] (10.70)	0.088[a] (5.13)
Constant	2.582[a] (57.41)	-	-	3.086[a] (72.96)	2.582[a] (28.58)

Note: a, b, and c refer to significance levels at %1, %5 and %10. Parenthesis shows the t-statistics. (DK, Driscoll-Kraay)

4.5. Quantile Regression

The results of the quantile regression are shown in Table 7 and Figure 1. These findings are similar to the outcomes of FE-OLS, FMOLS, DOLS, and Driscoll-Kraay estimators. Accordingly, EPE is positively affecting health status for all quantiles. From low to high quantiles, the effects of EPE on health status tend to rise gradually. More preciously, in European countries, EPE contributes to health status. There exists a negative impact of CO_2 emissions on health status across all quantiles. The magnitude of the impact rises as the quantiles rise. In other words, in European countries, CO_2 emissions worsen health status.

The effect of GDP and education on health status is significantly positive at all quantiles. That is, in European countries, GDP and education contribute to health status. As the quantiles rise, the extent to which GDP and education influence health status continues to slightly decrease. While the influence of GDP and education on health status is marginally large in low-income countries, this influence decreases in high-income countries. One plausible explanation for this is that environmental pollution is suppressing health status. Also, with economic growth, health status initially improves quickly but subsequently begins to decline. Depending on their level of economic development, different nations may perform better or worse than others (Baum et al., 2018; Freeman et al., 2020; Salehnia et al., 2022).

Table 7: The Results of Panel Quantile Regression

Variables	Lower Quantile			Middle Quantile			Higher Quantile		
	10th	20th	30th	40th	50th	60th	70th	80th	90th
EPE	0.008[c] (1.68)	0.009[b] (2.24)	0.009[a] (2.79)	0.010[a] (3.35)	0.010[a] (3.20)	0.011[a] (2.86)	0.011[b] (2.56)	0.012[b] (2.33)	0.012[b] (2.09)
CO2	-0.044[a] (-5.37)	-0.048[a] (-7.28)	-0.051[a] (-9.10)	-0.057[a] (-11.01)	-0.061[a] (-10.82)	-0.064[a] (-9.88)	-0.067[a] (-8.97)	-0.069[a] (-8.21)	-0.072[a] (-7.41)
GDP	0.097[a] (10.66)	0.092[a] (12.63)	0.089[a] (14.21)	0.084[a] (14.75)	0.080[a] (12.84)	0.076[a] (10.63)	0.074[a] (8.91)	0.071[a] (7.60)	0.068[a] (6.28)
EDU	0.095[a] (3.78)	0.093[a] (4.61)	0.091[a] (5.36)	0.089[a] (5.81)	0.087[a] (5.15)	0.086[a] (4.34)	0.085[a] (3.71)	0.084[a] (3.23)	0.082[a] (2.75)
Note: a, b, and c refer to significance levels at %1, %5 and %10. Parenthesis shows the z-statistics									

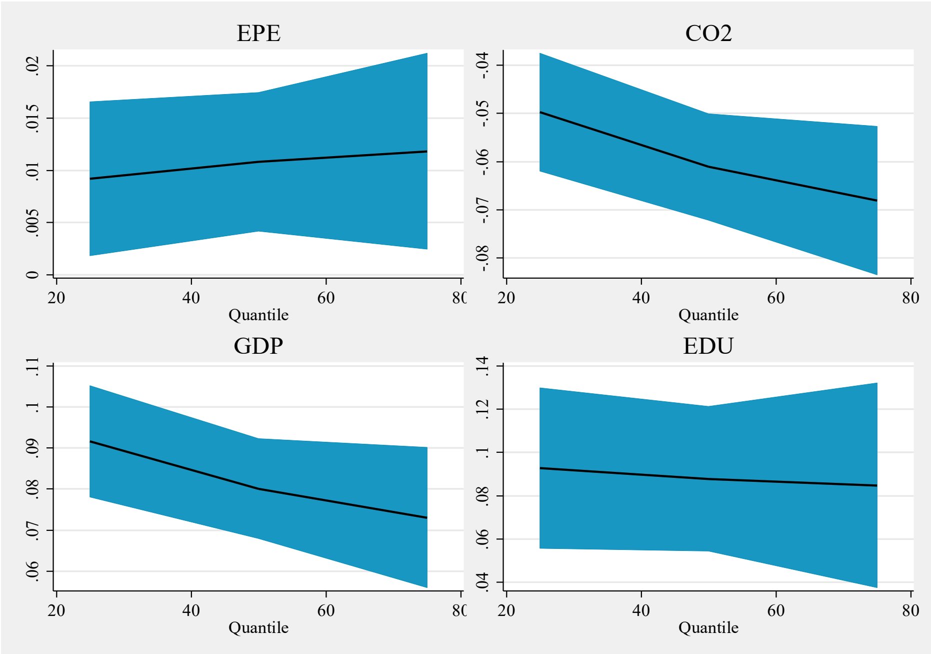

Figure 1: Panel Quantile Regressions Coefficients of EPE, CO_2, GDP, and EDU

4.6. Causality Analysis

The results of the DH causality analysis are shown in Table 8. The results show that a bidirectional causal relationship exists between LE and EPE, between LE and CO_2, and between LE and education. Besides, there exists a bidirectional causation between EPE and CO_2, between EPE and GDP per capita, between EPE and education, between CO_2 and education, and between education and GDP per capita. On the other hand, there is unidirectional causation existing from GDP per capita to CO_2, and from GDP per capita to LE.

Table 8: DH Causality Test Result

H_0 Hypothesis	Zwald	Zwtilde	Result
EPE⇏LEXP	2.583 (0.010)	1.908 (0.056)	EPE⇔LEXP
LEXP⇏EPE	4.546 (0.000)	3.560 (0.000)	*bidirectional*
EPE⇏CO2	6.523 (0.000)	5.224 (0.000)	EPE⇔CO2
CO2⇏EPE	5.693 (0.000)	4.525 (0.000)	*bidirectional*
EPE⇏GDP	3.355 (0.001)	2.558 (0.011)	EPE⇔GDP
GDP⇏EPE	5.468 (0.000)	4.336 (0.000)	*bidirectional*
EPE⇏EDU	4.935 (0.000)	3.887 (0.000)	EPE⇔EDU
EDU⇏EPE	3.025 (0.002)	2.280 (0.023)	*bidirectional*
CO2⇏LEXP	5.693 (0.000)	4.525 (0.000)	CO2⇔LEXP
LEXP⇏CO2	20.075 (0.000)	16.630 (0.000)	*bidirectional*
GDP⇏LEXP	5.468 (0.000)	4.336 (0.000)	GDP⇒LEXP
LEXP⇏GDP	0.336 (0.737)	0.017 (0.987)	*unidirectional*
EDU⇏LEXP	3.025 (0.002)	2.280 (0.023)	EDU⇔LEXP
LEXP⇏EDU	6.512 (0.000)	5.215 (0.000)	*bidirectional*
GDP⇏CO2	11.247 (0.000)	9.200 (0.000)	GDP⇒CO2
CO2⇏GDP	1.068 (0.285)	0.633 (0.527)	*unidirectional*
EDU⇏CO2	11.633 (0.000)	9.525 (0.000)	EDU⇔CO2
CO2⇏EDU	7.189 (0.000)	5.784 (0.000)	*bidirectional*
EDU⇏GDP	3.030 (0.002)	2.284 (0.022)	EDU⇔GDP
GDP⇏EDU	2.281 (0.023)	1.654 (0.098)	*bidirectional*
(⇏,⇔,⇒, and a) denotes null hypothesis, bidirectional and unidirectional causality, and 1% significance level, respectively.			

5. CONCLUSIONS AND POLICY INSIGHTS

Environmental pollution is one of the most dangerous global issues that nations all over the world have to deal with. Therefore, expenditures and investments to protect the environment continue to be important policy tools for countries. A large body of the literature has focused on the environmental degradation-health status nexus unraveling the causative association. However, little or nothing is clear about the role of environmental protection expenditure on health status.

This study investigates the impacts of environmental protection expenditure, environmental degradation, GDP per capita and education on health status for a panel of 20 European economies from 1995 to 2019. The study first employs the cross-sectional dependence tests to test cross-sectional dependence and Pesaran and Yamagata (2008) to test the panel data heterogeneity. Secondly, the stationarity of the variables is examined by the CIPS test. Thirdly, the cointegration between the variables is tested by Westerlund's (2008) test. Fourthly, the long-run estimates are obtained using FE-OLS, FMOLS, DOLS and Driskoll-Kraay techniques. Also, Panel quantile regression is used to reveal the effects of various factors on life expectancy at different quantities. Finally, the causality between the variables is tested by the Dumitrescu-Hurlin panel causality test.

The results reveal that Westerlund's (2008) cointegration technique confirms the long-run equilibrium relationships between the series. Moreover, FE-OLS, FMOLS, DOLS and DK techniques reveal the significant positive influence of EPE, GDP per capita and education on health status, whereas environmental degradation has a negatively significant effect. The results of panel quantile regression are consistent with the results of FE-OLS, FMOLS, DOLS, and Driscoll-Kraay estimators. The findings suggest EPE contributes positively to human health, so the increase in EPE is an important factor in improving life expectancy in 20 European countries. EPE contribute positively to human health by reducing environmental degradation (Onofrei, et al. 2020). Since CO_2 emissions are the main cause of climate change and global warming, their impact on LE is negative. The increase in environmental pollution will adversely affect human health (Majeed & Ozturk, 2020; Mahalik et al., 2022, Rahman et al., 2022a). The positive impact of per capita income and education on life expectancy may be due to the fact that when income increases and people receive a better education, they care more about their health (Majeed & Khan, 2019; Chireshe & Ocran, 2020; Wang et al., 2020a; Rahman & Alam, 2021; Chen et al., 2021; Salehnia et al., 2022). However, the DH causality test illustrates a feedback causality between LE and EPE, CO_2 and EPE, GDP and EPE, education and EPE, LE and education, education and CO_2, GDP and education. Moreover, there is a unidirectional causal relationship existing from GDP per capita to CO_2 emissions, and from GDP per capita to LE.

Important implications for the policy can be drawn from the results of this study. First, environmental protection expenditure may help improve health status. If European countries want to improve their health status, they should turn to policies that will reduce the negative effects of environmental degradation and encourage the adoption and use of environmental protection expenditures.

Therefore, promoting research and investment activities aimed at protecting the environment should be one of the priority targets. Since the environment is vital to improving health status, more resources should be devoted to technological developments and research to protect the environment to prevent the deterioration of health status. Second, CO2 emissions worsen health status in a threatening manner. Third, GDP per capita and education can improve health status. Moreover, European policymakers should create and implement policies that prioritize growth and education in order to enhance health status.

In addition to the above conclusions, this study also identifies some limits that could be used to guide future research. Firstly, this study focused only on European countries. Therefore, the results obtained from this study may not be generalized to developing and low-income countries. Future research should focus on developing and low-income country economies in order to reach additional conclusions and facts. Second, this study focused on the influence of environmental protection expenditures on health status. Subsequent studies should focus on the role of other government spending on environmental protection, such as spending on biodiversity and landscape protection, environmental protection R&D, pollution abatement, expenditure on waste management, and expenditure on wastewater management.

6. CONFLICT OF INTEREST STATEMENT

There is no conflict of interest between the authors.

7. FUNDING ACKNOWLEDGEMENTS

This research received no specific grant from any funding agency.

8. AUTHOR CONTRIBUTIONS

DB: The idea;
DB, AT: Collection and / or processing of resources;
DB: Empirical Analysis and / or interpretation;
DB, AT: Literature search;
DB, AT: Writer.

9. ETHICS COMMITTEE STATEMENT AND INTELLECTUAL PROPERTY COPYRIGHTS

Ethics committee principles were followed in the study. There has been no situation requiring permission within the framework of intellectual property and copyrights.

10. REFERENCES

Akbar, M. W., Zhong, R., Zia, Z., & Jahangir, J. (2022). Nexus between disaggregated energy sources, institutional quality, and environmental degradation in BRI countries: a penal quantile regression analysis. *Environmental Science and Pollution Research*, *29*(28), 43155-43168.

Akram, R., Chen, F., Khalid, F., Huang, G., & Irfan, M. (2021). Heterogeneous effects of energy efficiency and renewable energy on economic growth of BRICS countries: a fixed effect panel quantile regression analysis. *Energy*, *215*, 119019.

Akram, R., Chen, F., Khalid, F., Ye, Z., & Majeed, M. T. (2020). Heterogeneous effects of energy efficiency and renewable energy on carbon emissions: Evidence from developing countries. *Journal of Cleaner Production*, *247*, 119122.

Akter, K., Tasnime, Z., & Uddin, S. N. (2020). Role of globalization and financial development on the population's health status in the South Asian Countries: A panel quantile regression investigation. *International Journal of Science and Business*, *4*(11), 82-92.

Al-Azri, M., Al-Mamari, F., & Mondal, S. (2020). Healthcare expenditure and health outcome nexus: Exploring the evidences from Oman. *Journal of Public Affairs*, *20*(4), e2329.

Alharthi, M., & Hanif, I. (2021). The role of energy types and environmental quality on human health in developing Asian countries. *Energy & Environment*, *32*(7), 1226-1242.

Alharthi, M., Dogan, E., & Taskin, D. (2021). Analysis of CO2 emissions and energy consumption by sources in MENA countries: evidence from quantile regressions. *Environmental Science and Pollution Research*, *28*(29), 38901-38908.

Alimi, O. Y., & Ajide, K. B. (2021). The role of institutions in environment–health outcomes Nexus: empirical evidence from sub-Saharan Africa. *Economic Change and Restructuring*, *54*(4), 1205-1252. https://doi.org/10.1007/s10644-020-09299-0

Altıntaş, H., & Kassouri, Y. (2020). Is the environmental Kuznets Curve in Europe related to the per-capita ecological footprint or CO2 emissions?. *Ecological Indicators, 113*, 106187.

Amin, A., Liu, Y., Yu, J., Chandio, A. A., Rasool, S. F., Luo, J., & Zaman, S. (2020). How does energy poverty affect economic development? A panel data analysis of South Asian Countries. *Environmental Science and Pollution Research*, *27*(25), 31623-31635.

Amin, S., Jamasb, T., & Nepal, R. (2021). Regulatory reform and the relative efficacy of government versus private investment on energy consumption in South

Asia. *Economic Analysis and Policy*, *69*, 421-433. https://doi.org/10.1016/j.eap.2020.12.019

Anser, M. K., Godil, D. I., Khan, M. A., Nassani, A. A., Zaman, K., & Abro, M. M. Q. (2021). The impact of coal combustion, nitrous oxide emissions, and traffic emissions on COVID-19 cases: a Markov-switching approach. *Environmental Science and Pollution Research*, *28*(45), 64882-64891.

Anwar, A., Siddique, M., Dogan, E., & Sharif, A. (2021). The moderating role of renewable and non-renewable energy in environment-income nexus for ASEAN countries: Evidence from Method of Moments Quantile Regression. *Renewable Energy*, *164*, 956-967.

Arora, N. K., & Mishra, I. (2021). COP26: more challenges than achievements. *Environmental Sustainability*, 1-4.

Asemane, Z., Emamgholipour, S., & Rshidian, A. (2015). Governance and public health outcome in OPEC countries. *Int J Rev Life Sci, 5*(10), 855-60.

Assi, A. F., Isiksal, A. Z., & Tursoy, T. (2021). Renewable energy consumption, financial development, environmental pollution, and innovations in the ASEAN+ 3 group: Evidence from (P-ARDL) model. *Renewable Energy*, *165*, 689-700. https://doi.org/10.1016/j.renene.2020.11.052

Awan, A., Kocoglu, M., Banday, T. P., & Tarazkar, M. H. (2022). Revisiting global energy efficiency and CO2 emission nexus: fresh evidence from the panel quantile regression model. *Environmental Science and Pollution Research*, 1-14.

Azam, M., Uddin, I., & Saqib, N. (2022). The determinants of life expectancy and environmental degradation in Pakistan: evidence from ARDL bounds test approach. *Environmental Science and Pollution Research*, 1-14.

Balan, F. (2016). Environmental quality and its human health effects: A causal analysis for the EU-25. *International Journal of Applied Economics*, *13*(1), 57-71.

Baloch, M.A., Khan, S.U.D., & Ulucak, Z.Ş. (2020a). Poverty and vulnerability of environmental degradation in Sub-Saharan African countries: what causes what?. *Structural Change and Economic Dynamics*, *54*, 143-149. https://doi.org/10.1016/j.strueco.2020.04.007

Baloch, M.A., Khan, S.U.D., Ulucak, Z.Ş., & Ahmad, A. (2020b). Analyzing the relationship between poverty, income inequality, and CO2 emission in Sub-Saharan African countries. *Science of The Total Environment*, *740*, 139867. https://doi.org/10.1016/j.scitotenv.2020.139867

Banday, U. J., & Kocoglu, M. (2022). Modelling simultaneous relationships between human development, energy, and environment: Fresh evidence from panel quantile regression. *Journal of the Knowledge Economy*, 1-23.

Barua, S., Adeleye, B. N., Akam, D., Ogunrinola, I., & Shafiq, M. M. (2022). Modeling mortality rates and environmental degradation in Asia and the Pacific: does income group matter?. *Environmental Science and Pollution Research*, *29*(20), 30548-30567.

Basoglu, A., & Uzar, U. (2019). An empirical evaluation about the effects of environmental expenditures on environmental quality in coordinated market economies. *Environmental Science and Pollution Research*, *26*(22), 23108-23118.

Baum, F., Popay, J., Delany-Crowe, T., Freeman, T., Musolino, C., Alvarez-Dardet, C., ... & Sanders, D. (2018). Punching above their weight: a network to understand broader determinants of increasing life expectancy. *International Journal for Equity in Health*, *17*(1), 1-5.

Bayar, Y., Gavriletea, M. D., Estes, J., & Pintea, M. O. (2022). Impact of banking sector development and environment on population health: evidence from EU transition countries. *Economic Research-Ekonomska Istraživanja*, 1-24.

Bernstein, J. A., Alexis, N., Barnes, C., Bernstein, I. L., Nel, A., Peden, D., ... & Williams, P. B. (2004). Health effects of air pollution. *Journal Of Allergy and Clinical Immunology, 114*(5), 1116-1123.

Bhat, J. A. (2018). Renewable and non-renewable energy consumption—impact on economic growth and CO2 emissions in five emerging market economies. *Environmental Science and Pollution Research, 25*(35), 35515-35530. https://doi.org/10.1007/s11356-018-3523-8

Bilgili, F., Ozturk, I., Kocak, E., Kuskaya, S., & Cingoz, A. (2022). The nexus between access to electricity and CO2 damage in Asian Countries: The evidence from quantile regression models. *Energy and Buildings*, *256*, 111761.

Bostan, I., Onofrei, M., Elena-Doina Dascălu, B., Fîrtescu, & Toderascu C. (2016). Impact of sustainable environmental expenditures policy on air pollution reduction, during european integration framework. *Amfiteatru Economic, 18*(42), 286–302.

Bouchoucha, N. (2021). The effect of environmental degradation on health status: Do institutions matter?. *Journal of the Knowledge Economy*, *12*(4), 1618-1634.

Boukhelkhal, A. (2021). Energy use, economic growth and CO2 emissions in Africa: does the environmental Kuznets curve hypothesis exist? New evidence from heterogeneous panel under cross-sectional dependence. *Environment, Development and Sustainability*, 1-28. https://doi.org/10.1007/s10668-021-01983-z

British Petrol Statistical Review of World Energy (2021). Statistical Review of World Energy. Accessed at: https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html, Accessed March 2022

Broniewicz, E. (2011). Environmental protection expenditure in European Union. *Environmental Management in Practice*, *21*(36), 2-28.

Bui, Q., Wang, Z., Zhang, B., Le, H. P., & Vu, K. D. (2021). Revisiting the biomass energy-economic growth linkage of BRICS countries: A panel quantile regression with fixed effects approach. *Journal of Cleaner Production*, *316*, 128382. https://doi.org/10.1016/j.jclepro.2021.128382

Bunyaminu, A., Mohammed, I., Yakubu, I. N., Shani, B., & Abukari, A. L. (2022). The effect of health expenditure on average life expectancy: does government effectiveness play a moderating role?. *International Journal of Health Governance*, (ahead-of-print).

Chaabouni, S., Zghidi, N., & Mbarek, M. B. (2016). On the causal dynamics between CO2 emissions, health expenditures and economic growth. *Sustainable Cities and Society*, *22*, 184-191.

Chen, Z., Ma, Y., Hua, J., Wang, Y., & Guo, H. (2021). Impacts from economic development and environmental factors on life expectancy: a comparative study based on data from both developed and developing countries from 2004 to 2016. *International Journal of Environmental Research and Public Health*, *18*(16), 8559.

Cheng, C., Ren, X., Wang, Z., & Yan, C. (2019). Heterogeneous impacts of renewable energy and environmental patents on CO2 emission-Evidence from the BRIICS. *Science of the Total Environment*, *668*, 1328-1338.

Chireshe, J., & Ocran, M. K. (2020). Health care expenditure and health outcomes in sub-Saharan African countries. *African Development Review*, *32(3),* 349-361.

Cropper, M. L. (1981). Measuring the benefits from reduced morbidity. *The American Economic Review*, *71*(2), 235-240.

Danish, Zhang, B., Wang, B., & Wang, Z. (2017). Role of renewable energy and non-renewable energy consumption on EKC: evidence from Pakistan. *Journal of Cleaner Production, 156,* 855-864.

Dogan, E., & Inglesi-Lotz, R. (2020). The impact of economic structure to the environmental Kuznets curve (EKC) hypothesis: evidence from European countries. *Environmental Science and Pollution Research*, *27(11),* 12717-12724. https://doi.org/10.1007/s11356-020-07878-2

Dogan, E., & Seker, F. (2016). Determinants of CO2 emissions in the European Union: the role of renewable and non-renewable energy. *Renewable Energy*, *94*, 429-439. https://doi.org/10.1016/j.renene.2016.03.078

Doucouliagos, C., Hennessy, J., & Mallick, D. (2021). Health aid, governance and infant mortality. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *184*(2), 761-783.

Driscoll, J. C., & Kraay, A. C. (1998). Consistent covariance matrix estimation *with spatially dependent panel data. Review of Economics and Statistics, 80*(4), 549-560. https://doi.org/10.1162/003465398557825

Dumitrescu, E. I., & Hurlin, C. (2012). Testing for Granger non-causality in heterogeneous panels. *Economic Modelling*, *29*(4), 1450-1460. https://doi.org/10.1016/j.econmod.2012.02.014

Ecevit, E., & Çetin, M. (2016). Ekonomik büyüme ve çevre kirliliğinin sağlık üzerindeki etkisi: Türkiye ile ilgili ampirik kanıt. *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *48,* 83-98.

Ecevit, E., Çetin, M., & Yücel, A. G. (2022). Türkiye'de yenilenebilir enerji ve sağlık: eşbütünleşme ve nedensellik analizi. *Erciyes Akademi*, *36*(1), 138-156.

Erdoğan, S., Yıldırım, D. Ç., & Gedikli, A. (2019). The relationship between CO2 emissions and health indicators: The case of Turkey. *Econ Lett*, *6*(1), 28-39.

European Environment Agency (2020). Air pollution, https://www.eea.europa.eu/themes/air/intro , Accessed date: 15.09.2022

European Environment Agency (2021). Air quality in Europe 2021, https://www.eea.europa.eu/publications/air-quality-in-europe-2021, Accessed date: 15.09.2022

European Environment Agency (EEA, 2022). Environment and health, https://www.eea.europa.eu/themes/human/intro (Accessed date: 04.08.2022)

Farag, M., Nandakumar, A. K., Wallack, S., Hodgkin, D., Gaumer, G., & Erbil, C. (2013). Health expenditures, health outcomes and the role of good governance. *International Journal of Health Care Finance and Economics, 13*(1), 33-52

Farzanegan, M. R., & Mennel, T. (2012). Fiscal decentralization and pollution: Institutions matter. *Magks Papers on Economics, 22*, 1–28.

Fayissa, B., & Gutema, P. (2008). A health production function for Sub-Saharan Africa (SSA). *Department of Economics and Finance Working Paper Series*, 112-118

Freeman, T., Gesesew, H. A., Bambra, C., Giugliani, E. R. J., Popay, J., Sanders, D., ... & Baum, F. (2020). Why do some countries do better or worse in life expectancy relative to income? An analysis of Brazil, Ethiopia, and the United States of America. *International Journal for Equity in Health*, *19*(1), 1-19.

Gerking, S., & Stanley, L. R. (1986). An economic analysis of air pollution and health: the case of St. Louis. *The Review of Economics and Statistics*, *68,* 115-121.

Grossman, M. (1972). *The demand for health: A theoretical and empirical investigation*. NBER: New York.

Haseeb, M., Kot, S., Hussain, H. I., & Jermsittiparsert, K. (2019). Impact of economic growth, environmental pollution, and energy consumption on health expenditure and R&D expenditure of ASEAN countries. *Energies, 12*(19), 3598.

He, L., Wu, M., Wang, D., & Zhong, Z. (2018). A study of the influence of regional environmental expenditure on air quality in China: the effectiveness of environmental policy. *Environmental Science and Pollution Research*, *25*(*8*), 7454-7468.

Hendrawaty, E., Shaari, M. S., Kesumah, F. S. D., & Ridzuan, A. R. (2022). Economic growth, financial development, energy consumption and life expectancy: fresh evidence from ASEAN countries. *International Journal of Energy Economics and Policy*, *12*(2), 444-448.

Hossain, S., Siddika, M. A., Koly, I. J., & Akter, K. (2020). Exploring the impact of environmental degradation on life expectancy in Bangladesh: An ARDL bounds test approach. *International Journal of Science and Business*, *4*(12), 69-79.

Huang, J. T. (2018). Sulfur dioxide (SO2) emissions and government spending on environmental protection in China: Evidence from spatial econometric analysis. *Journal of Cleaner Production, 175*, 431–441.

Hussain, M. N., Li, Z., & Sattar, A. (2022). Effects of urbanization and nonrenewable energy on carbon emission in Africa. *Environmental Science and Pollution Research*, *29*(17), 25078-25092.

Ibrahim, R. L. (2022). Beyond COP26: can income level moderate fossil fuels, carbon emissions, and human capital for healthy life expectancy in Africa?. *Environmental Science and Pollution Research*, 1-15.

Ibrahim, R. L., & Ajide, K. B. (2021). The role of income level and institutional quality in the non-renewable energy consumption and life expectancy nexus: evidence from selected oil-producing economies in Africa. *OPEC Energy Review*, *45*(3), 341-364.

Ibrahim, R. L., Ajide, K. B., & Omokanmi, O. J. (2021). Non-renewable energy consumption and quality of life: Evidence from Sub-Saharan African economies. *Resources Policy*, *73*, 102176.

Ibukun, C. O. (2021). The role of governance in the health expenditure– health outcomes nexus: insights from West Africa. *International Journal of Social Economics. 48(4),* 557-570

International Monetary Fund (2021). Environmental protection expenditures. Accessed at: https://climatedata.imf.org/datasets/d22a6decd9b147fd9040f793082b219b_0/about, https://databank.worldbank.org/source/world-development-indicators, Accessed March 2022

Iqbal, A., Tang, X., & Rasool, S. F. (2022). Investigating the nexus between CO2 emissions, renewable energy consumption, FDI, exports and economic growth: evidence from BRICS countries. *Environment, Development and Sustainability*, 1-30. https://doi.org/10.1007/s10668-022-02128-6

Juginović, A., Vuković, M., Aranza, I., & Biloš, V. (2021). Health impacts of air pollution exposure from 1990 to 2019 in 43 European countries. *Scientific Reports*, *11*(*1*), 1-15.

Kafili, V., & Ghasemzade, M. (2019). The role of good governance in the influence of government expenditure on health. *The Journal of Planning and Budgeting, 23*(4), 137-161.

Klomp, J., & De Haan, J. (2008). Effects of governance on health: A cross-national analysis of 101 countries. *Kyklos, 61*(4), 599-614.

Koçak, E., Ulucak, R., & Ulucak, Z. Ş. (2020). The impact of tourism developments on CO2 emissions: An advanced panel data estimation. Tourism Management Perspectives, 33, 100611.

Krajewski, P. (2016). The impact of public environmental protection expenditure on economic growth. *Problemy Ekorozwoju–Problems of Sustainable Development*, *11*(2), 99-104.

Kumar, P., Sahu, N. C., Kumar, S., & Ansari, M. A. (2021). Impact of climate change on cereal production: evidence from lower-middle-income countries. *Environmental Science and Pollution Research, 28*(37), 51597-51611. https://doi.org/10.1007/s11356-021-14373-9

Li, Z. Z., Li, R. Y. M., Malik, M. Y., Murshed, M., Khan, Z., & Umar, M. (2021). Determinants of carbon emission in China: how good is green investment?. *Sustainable Production and Consumption, 27*, 392-401. https://doi.org/10.1016/j.spc.2020.11.008

Lu, Z. N., Chen, H., Hao, Y., Wang, J., Song, X., & Mok, T. M. (2017). The dynamic relationship between environmental pollution, economic development and public health: Evidence from China. *Journal of Cleaner Production*, *166*, 134-147.

M. Arafat, W. M. G., Haq, I. U., Mehmed, B., Abbas, A., Gamage, S. K. N., & Gasimli, O. (2022). The causal nexus among energy consumption, environmental degradation, financial development and health outcome: empirical study for Pakistan. *Energies*, *15*(*5*), 1859.

Mahalik, M. K., Le, T. H., Le, H. C., & Mallick, H. (2022). How do sources of carbon dioxide emissions affect life expectancy? Insights from 68 developing and emerging economies. *World Development Sustainability*, 100003. https://doi.org/10.1016/j.wds.2022.100003

Mahmoud, S. H., & Gan, T. Y. (2018). Impact of anthropogenic climate change and human activities on environment and ecosystem services in arid regions. *Science of the Total Environment*, *633*, 1329-1344.

Majeed, M. T., & Khan, F. N. (2019). Do information and communication technologies (ICTs) contribute to health outcomes? An empirical analysis. *Quality & Quantity*, *53*(*1*), 183-206. https://doi.org/10.1007/s11135-018-0741-6

Majeed, M. T., & Ozturk, I. (2020). Environmental degradation and population health outcomes: a global panel data analysis. *Environmental Science and Pollution Research*, *27*(13), 15901-15911.

Majeed, M. T., Luni, T., & Zaka, G. (2021). Renewable energy consumption and health outcomes: Evidence from global panel data analysis. *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, *15*(*1*), 58-93.

Manisalidis, I., Stavropoulou, E., Stavropoulos, A., & Bezirtzoglou, E. (2020). Environmental and health impacts of air pollution: A review. *Frontiers in Public Health, 8*(14), 1-13.

Matthew, O., Osabohien, R., Fasina, F., & Fasina, A. (2018). Greenhouse gas emissions and health outcomes in Nigeria: Empirical insight from ARDL technique. *International Journal of Energy Economics and Policy*, *8*(*3*), 43-50.

Merlin, M. L., & Chen, Y. (2021). Analysis of the factors affecting electricity consumption in DR Congo using fully modified ordinary least square (FMOLS), dynamic ordinary least square (DOLS) and canonical cointegrating regression (CCR) estimation approach. *Energy, 232*, 121025. https://doi.org/10.1016/j.energy.2021.121025

Murshed, M., Haseeb, M., & Alam, M. (2021). The environmental Kuznets Curve hypothesis for carbon and ecological footprints in South Asia: The role of renewable energy. *GeoJournal*, 1-28. https://doi.org/10.1007/s10708-020-10370-6

Murthy, U., Shaari, M. S., Mariadas, P. A., & Abidin, N. Z. (2021). The relationships between CO2 emissions, economic growth and life expectancy. *Journal of Asian Finance, Economics and Business, 8(2)*, 801-808.

Mutizwa, A., & Makochekanwa, A. (2015). Impact of environmental quality on health status: a study of 12 southern African development community (SADC) countries between 2000 and 2008. *Botswana Journal of Economics*, *13*(1), 87-111.

Neidell, M. J. (2004). Air pollution, health, and socio-economic status: the effect of outdoor air quality on childhood asthma. *Journal of Health Economics*, *23*(6), 1209-1236

Nicholas, A., Edward, N. A., & Bernardin, S. (2016). The effect of health expenditure on selected maternal and child health outcomes in Sub-Saharan Africa. *International Journal of Social Economics. 43*(12), 1386-1399.

Nkalu, C. N., & Edeme, R. K. (2019). Environmental hazards and life expectancy in Africa: evidence from GARCH model. *Sage Open*, *9*(1), 2158244019830500.

Ntarmah, A. H., Kong, Y., Obeng, A. F., & Gyedu, S. (2022). The role of bank financing in economic growth and environmental outcomes of sub-Saharan Africa: evidence from novel quantile regression and panel vector autoregressive models. *Environmental Science and Pollution Research*, 1-39. https://doi.org/10.1007/s11356-021-17947-9

OECD (2001). Human Health and the Environment. OECD Environmental Outlook, https://www.oecd.org/health/health-systems/32006565.pdf, Accessed date: 27.09.2022

OECD (2022). Environmental protection expenditure and revenues. https://stats.oecd.org/Index.aspx?DataSetCode=EPER (Accessed date: 04.08.2022).

Ojo Olusoji, O., Nwosa Philip, I., Alake Olamide, J., & Adebanji Funmilola, B. (2020). Health expenditure and life expectancy in Nigeria. *Lead City Journal of the Social Sciences, 5(1*), 66-71.

Omri, A., Kahouli, B., Afi, H., & Kahia, M. (2022). Impact of environmental quality on health outcomes in Saudi Arabia: Does research and development matter?. *Journal of the Knowledge Economy*, 1-26.

Onofrei, M., Bostan, I., Filip, B. F., Popescu, C. L., & Jitaru, G. (2020). Impacts of the allocation of governmental resources for improving the environment. An empirical analysis on developing European countries. *International Journal of Environmental Research and Public Health*, *17*(*8*), 2783. doi:10.3390/ijerph17082783

Ortiz-Ospina, E. (2019). Global health. *Our world in data*. https://ourworldindata.org/health-meta#public-policy-and-regulation (Accessed date: 15.09.2022).

Osakede, U. A. (2020). Public health spending and health outcome in Nigeria: the role of governance. *International Journal of Development Issues, 20*(1), 95-112.

Owumı, B., & Alfred, E. (2021). An assessment of the contribution of healthcare expenditure to life expectancy at birth in Nigeria. *Journal of Public Health*, 1-9.

Pedroni, P. (2001). Purchasing power parity tests in cointegrated panels. Review of Economics and statistics, 83(4), 727-731. https://doi.org/10.1162/003465301753237803

Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics, 22*(2), 265-312. https://doi.org/10.1002/jae.951

Pesaran, M. H., & Yamagata, T. (2008). Testing slope homogeneity in large panels. *Journal of Econometrics*, *142*(*1*), 50-93.

Radmehr, M., & Adebayo, T. S. (2022). Does health expenditure matter for life expectancy in Mediterranean countries?. *Environmental Science and Pollution Research*, 1-13.

Rahman, M. M., & Alam, K. (2021). The nexus between health status and health expenditure, energy consumption and environmental pollution: Empirical evidence from SAARC-BIMSTEC regions. *BMC Public Health*, *21*(*1*), 1-12.

Rahman, M. M., & Alam, K. (2022a). Life expectancy in the ANZUS-BENELUX countries: The role of renewable energy, environmental pollution, economic growth and good governance. *Renewable Energy*, *190*, 251-260.

Rahman, M. M., & Alam, K. (2022b). Effects of globalization, energy consumption and ICT on health status in Australia: The role of financial development and education. *BMC Public Health*, *22*(*1*), 1-13.

Rahman, M. M., Alam, K., & Khanam, R. (2022b). Socio-economic factors affecting high infant and child mortality rates in selected African Countries: Does globalisation play any role?. *Globalization and Health*, *18*(1), 1-13.

Rahman, M. M., Alam, K., & Velayutham, E. (2021). Is industrial pollution detrimental to public health? Evidence from the world's most industrialised countries. *BMC Public Health*, *21*(*1*), 1-11.

Rahman, M. M., Khanam, R., & Rahman, M. (2018). Health care expenditure and health outcome nexus: New evidence from the SAARC-ASEAN region. *Globalization and Health, 14(1),* 1-11.

Rahman, M.M., Rana R., Khanam, R (2022a). Determinants of life expectancy in most polluted countries: Exploring the effect of environmental degradation. *PLoS ONE 17*(1), e0262802. https:// doi.org/10.1371/journal.pone.0262802.

Raza, S. A., Shah, N., & Khan, K. A. (2020). Residential energy environmental Kuznets curve in emerging economies: the role of economic growth, renewable energy consumption, and financial development. *Environmental Science and Pollution Research, 27(5),* 5620-5629. https://doi.org/10.1007/s11356-019-06356-8

Rjoub, H., Odugbesan, J. A., Adebayo, T. S., & Wong, W. K. (2021). Investigating the causal relationships among carbon emissions, economic growth, and life expectancy in Turkey: evidence from time and frequency domain causality techniques. *Sustainability*, *13*(*5*), 2924.

Rodriguez-Alvarez, A. (2021). Air pollution and life expectancy in Europe: Does investment in renewable energy matter?. *Science of the Total Environment*, *792*, 148480.

Salehnia, N., Karimi Alavijeh, N., & Hamidi, M. (2022). Analyzing the impact of energy consumption, the democratic process, and government service delivery on life expectancy: evidence from a global sample. *Environmental Science and Pollution Research*, *29*(*24*), 36967-36984.

Saqib, M., & Benhmad, F. (2021). Does ecological footprint matter for the shape of the environmental Kuznets curve? Evidence from European countries. *Environmental Science and Pollution Research, 28*(11), 13634-13648. https://doi.org/10.1007/s11356-020-11517-1

Sarkodie, S. A., Strezov, V., Weldekidan, H., Asamoah, E. F., Owusu, P. A., & Doyi, I. N. Y. (2019). Environmental sustainability assessment using dynamic autoregressive-distributed lag simulations—nexus between greenhouse gas emissions, biomass energy, food and economic growth. *Science of the Total Environment, 668,* 318-332.

Sarkodie, S.A., & Strezov, V. (2019). Effect of foreign direct investments, economic development and energy consumption on greenhouse gas emissions in developing countries. *Science of the Total Environment*, *646*, 862-871. https://doi.org/10.1016/j.scitotenv.2018.07.365

Sharma, R., Shahbaz, M., Kautish, P., & Vo, X. V. (2022). Diversified imports as catalysts for ecological footprint: examining the BRICS experience. *Environment, Development and Sustainability*, 1-29. https://doi.org/10.1007/s10668-022-02177-x

Sheng, W., Wan, L., & Wang, C. (2021). The spillover effect of fiscal environmental protection spending on residents' medical and healthcare expenditure: evidence from China. *Environmental Geochemistry and Health*, 1-12. https://doi.org/10.1007/s10653-021-01146-z

Sheraz, M., Deyi, X., Ahmed, J., Ullah, S., & Ullah, A. (2021). Moderating the effect of globalization on financial development, energy consumption, human capital, and carbon emissions: evidence from G20 countries. *Environmental Science and Pollution Research, 28*(26), 35126-35144. https://doi.org/10.1007/s11356-021-13116-0

Shobande, O. A. (2020). The effects of energy use on infant mortality rates in Africa. *Environmental and Sustainability Indicators*, *5*, 100015.

Sial, M. H., Arshed, N., Amjad, M. A., & Khan, Y. A. (2022). Nexus between fossil fuel consumption and infant mortality rate: a non-linear analysis. *Environmental Science and Pollution Research*, 1-10.

Sirag, A., Mohamed Nor, N., Law, S. H., Abdullah, N. M. R., & Lacheheb, M. (2017). The impact of health financing and CO2 emission on health outcomes in Sub-Saharan Africa: A cross-country analysis. *GeoJournal*, *82*(6), 1247-1261.

Smith, P., Beaumont, L., Bernacchi, C. J., Byrne, M., Cheung, W., Conant, R. T., ... & Long, S. P. (2022). Essential outcomes for COP26. *Global Change Biology*, *28*(1), 1-3.

Tatli, H., & Barak, D. (2021). Sağlık harcamaları, hükümet etkinliği ve beklenen yaşam süresi: OECD ülkelerinden yeni kanıtlar. *Bingöl Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *5*(*2*), 65-97.

Tsai, S. S., Chen, C. C., & Yang, C. Y. (2022). The impacts of reduction in ambient fine particulate (PM2. 5) air pollution on life expectancy in Taiwan. *Journal of Toxicology and Environmental Health, Part A*, 1-8.

Ulucak, R., Yücel, A. G., & İlkay, S. Ç. (2020). Dynamics of tourism demand in Turkey: Panel data analysis using gravity model. *Tourism Economics, 26*(8), 1394-1414. https://doi.org/10.1177/1354816620901956

Ulucak, Z. S., & Yucel, A. G. (2021). Can renewable energy be used as an effective tool in the decarbonization of the Mediterranean region: Fresh evidence under cross-sectional dependence. *Environmental Science and Pollution Research, 28*(37), 52082-52092. https://doi.org/10.1007/s11356-021-14350-2

United Nations Development Programme (2020). Human development report. Accessed at: https://hdr.undp.org/en/indicators/69706, Accessed March 2022

Wang, Z., Asghar, M. M., Zaidi, S. A. H., Nawaz, K., Wang, B., Zhao, W., & Xu, F. (2020a). The dynamic relationship between economic growth and life expectancy: Contradictory role of energy consumption and financial development in Pakistan. *Structural Change and Economic Dynamics*, *53*, 257-266.

Wang, Z., Bui, Q., & Zhang, B. (2020b). The relationship between biomass energy consumption and human development: Empirical evidence from BRICS countries. *Energy*, *194*, 116906. https://doi.org/10.1016/j.energy.2020.116906

Wang, Z., Huang, W., & Chen, Z. (2019). The peak of CO2 emissions in China: a new approach using survival models. *Energy Economics, 81,* 1099-1108.

Wei, L., & Ullah, S. (2022). International tourism, digital infrastructure, and CO2 emissions: Fresh evidence from panel quantile regression approach. *Environmental Science and Pollution Research*, *29*(*24*), 36273-36280.

Westerlund, J. (2008). Panel cointegration tests of the Fisher effect. *Journal of Applied Econometrics, 23(2)*, 193-233. https://doi.org/10.1002/jae.967

WHO (2017). Protecting health in Europe from climate change: 2017 update. https://www.euro.who.int/__data/assets/pdf_file/0004/355792/ProtectingHealthEuropeFromClimateChange.pdf, Accessed date: 27.09.2022

World Bank (2022). World development indicators. Accessed at: https://databank.worldbank.org/source/world-development-indicators, Accessed March 2022

World Health Organization (WHO, 2022). Public health and environment, https://www.who.int/data/gho/data/themes/public-health-and-environment, (Accessed date: 04.08.2022).

Xie, Z., Wu, R., & Wang, S. (2021). How technological progress affects the carbon emission efficiency? Evidence from national panel quantile regression. *Journal of Cleaner Production*, *307*, 127133.

Yaqub, J. O., Ojapinwa, T. V., & Yussuff, R. O. (2012). Public health expenditure and health outcome in Nigeria: The impact of governance. *European Scientific Journal, 8*(13), 189-201.

Yasmeen, R., Zhaohui, C., Shah, W.U.H., Kamal, M.A., & Khan, A. (2021). Exploring the role of biomass energy consumption, ecological footprint through FDI and technological innovation in B&R economies: A simultaneous equation approach. *Energy*, 122703. https://doi.org/10.1016/j.energy.2021.122703

Yu, P., Xu, R., Li, S., Coelho, M. S., Saldiva, P. H., Sim, M. R., ... & Guo, Y. (2022). Loss of life expectancy from PM2. 5 in Brazil: A national study from 2010 to 2018. *Environment International*, *166*, 107350.

Zhang, J., Wang, B., & Latif, Z. (2019). Towards cross-regional sustainable development: The nexus between information and communication technology, energy consumption, and CO 2 emissions. *Sustainable Development, 27*(5), 990-1000. https://doi.org/10.1002/sd.2000.