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Natural resources environmental quality and economic development: Fresh analysis

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ABSTRACT

Natural resources influence ecosystem elements that lead to environmental degradation. The introduction of the Sustainable Development Goal (SGD) has increased attention on environmental issues. As a result, this study aims to determine whether or not natural resources have a significant role in influencing ecological protection and emissions of glasshouse gases. Using a cross-sectional autoregressive distributed lags model, this study aims to determine the impact of economic recovery, natural resources, and renewable and non-renewable energy use on carbon dioxide emissions in ten European countries (Austria, France, Hungary, Ireland, Iceland, UK, Germany, Finland, Italy, Spain and Switzerland) from 2000 to 2020. These countries were selected because of their high GDPs in Europe (CS-ARDL). All countries' [illegible]n elasticities were estimated. According to the study, using non-renewable and renewable energy leads to economic recovery in these nations. Even though natural resources constrain economic growth in countries, they also drive economic activity in such countries. Economic recovery and non-renewable energy sources increase carbon emissions, but renewable energy lowers emissions. Carbon dioxide [illegible] emissions and natural resources were also factors in each panel. These locations might benefit from policies that encourage renewable energy to minimize CO$_2$ emissions and enhance educational systems to increase economic development.

1. Introduction

There has been a significant rise in energy security and environmental deterioration due to economic expansion, industrialization, and growth(Shang et al., 2021). The proper management of a wide range of ecological systems, both in Australia and around the world, has been associated with two knowledge exchanges (Saghiri et al., 2017). Native knowledge may be shared between Indigenous and non-peoples, non-Indigenous understanding can be shared with Indigenous peoples (X. Wu et al., 2021) and all sorts of information can be shared within Indigenous peoples with the taking the time to share and weavers of various knowledge [illegible] contributing to advancements in forest management, natural and cultural managing resources To denote the corpus of information that can (mainly) be traced back to indigenous people, we'll refer to it as "Indigenous generated knowledge." The term "European created information" is often used to refer to a variety of different kinds of information (with the recognition that not all non-Indigenous knowledge has a western origin). Native American and Western researchers are encouraged to collaborate in ILSMPs, which provides a wide range of learning and information possibilities for both groups(Z. L. Zhang et al., 2021). KE generally has been found to increase responsible use and natural resources management, conserve energy and lessen environmental threats. This KE has been related to favorable ecological outcomes(S. Y. S. E. Barykin et al., 2021). Despite the knowledge that complicated social elements comprise related natural and human sub-systems or kingdoms, there is undoubtedly less recognized about the influence of environmental assets management-related KE on individuals, despite the necessity of knowing the consequences of KE on both the naturally occurring and human-related post. ILSMPs' role in supporting Indigenous people's access to knowledge (KE) is the primary focus of this paper (hereafter referred to as ILSMP-facilitated KE). Initial research on the social and economic operating of PES schemes has centered on: I) trying to identify the optimum solution structural and financial circumstances for their execution, Ii) characterizing ecosystem benefits and assess the quality of PES projects, and III) recognizing one's efforts to poverty alleviation(Qiao et al., 2022).

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PES schemes may only be characterized as such if payments are paid to environment network operators contingent on the adoption of particular actions that are regarded favorable to the preservation of the ecological system in the issue (Hossain et al., 2020). argues this from an environmental and economic viewpoint. Environment transfers (PES) are defined as “transactions of assets among social action, [with] the] aim [of] providing incentives to match personal and collective property use choices with societal purpose in the management of natural resources. According to(S. E. S. Y. Barykin et al., 2021). They admit that socio-economic contexts (e.g., institutional configurations based on cultural practices) should be taken into account when implementing PES strategies while also recognizing that constraint is more of a hypothetical goal than a characteristic that can be witnessed in most on-the-ground conservation efforts branded as PES in Central America(Pan et al., 2021).

Across the globe, the entire ecosystem is being used to assess the environmental viability of a population (Lei et al., 2022).was the first scholar to write about the carbon impact using the phrase maximum load (Y. Wu and Zhu, 2021).coined the entire ecosystem for ease of understanding. To put it another way, the environmental footprint is an indicator of how much mineral wealth humans use. The environmental imprint, as defined by, evaluates people’s stress on the planet’s ecological assets. The fundamental sustainability principle that materials should not be included more than their potential for regeneration is where the carbon impact starts(Y. J. Chen et al., 2021).When calculating one’s ecological impact, one considers how many resources one consumes concerning how much one produces. As a population grows, so does its requirement for biological materials to generate the energy it exhausts and swallow wastes, including carbon dioxide emissions (Frederico & Garza-reyes, 2020). The biosphere measures a population’s natural assets’ ability to produce goods and services. This means that the demand for the goods and services that resources may give, such as fruit and vegetables, meats, woods, fisheries, and kinds of cotton, exceeds the ability of the natural surroundings to replenish. This results in [illegible] environmental scarcity. When the biosphere surpasses ecological impact, environmental buffers are established(H[illegible]as et al., 2022). As an appropriate analytical tool, the entire ecosystem is used in this research to measure air sustainability."Trading environment to research has been an increasing concern for analytical scientists(Z. Zhang et al., 2021). Many of these critics have focused on the power and political interactions that decide the demand for eco-friendly methods (such as casing, privatization, or commodity commercialization), as well as how this demand for eco-friendly methods generates new social and economic agreements by trying to redefine positions, privileges, and obligations for different actors concerning natural resources(Zhabko et al., 2019). To begin with, it is important to recognize that PES plans often overlook the importance of social and political factors of the landscape and assets in issue. When [illegible] fresh water, these societal and political aspects also include a function of fresh water itself as a means for achieving multiple styles of government and societal conflicts as well as the construction of water [illegible] as a means for achieving broader economic [illegible] (Sacks et al., 2020).

Following are some of how this research contributes: The quantity of renewable and non-renewable energy derived from natural resources and greenhouse gas emissions all go hand in hand. We’re doing this research to examine whether European countries’(Austria, France, Hungary, Ireland, Iceland, United Kingdom, Germany, Finland, Italy, Spain and Switzerland) carbon emissions may be reduced via the use of natural resource rent, renewable and non-renewable energy, and economic recovery. The analysis is carried out using the pooled mean group (PMG) and dynamic common correlated effects (DCCE) cross-sectional augmented autoregressive distributed lag (CS-ARDL).

The remainder of the paper is organized as follows: the next section contains a literature review. Data and methodology are discussed in section three. Section four is devoted to results and discussion. The last section contains the conclusion and policy implications.

2. Literature review

Economic complexity index and environmental, financial growth capacity, and competence are measured by the ECI, which is also seen as a viable pollution-reduction strategy(Kurka, 2019). By this, I mean that any industry may create, develop, and appropriately generate items that are timely, distinctive, difficult to copy, original, and unique as a mirror of its progress in terms of technical developments and intervention creativity.

Many studies on PES principles and application have mainly focused on the rationalization for the notion and its application in practice and efficiency(Aslam et al., 2020); however, ideological ecologists perspective can help for nearing the assessment of PES projects and results since it tries to draw attention to the social relations and interplay allegedly involved in changes in the environment and strategy initiating. Existence is not given but conceived, developed, and constituted in specific ways (L. Zhang et al., 2022) and [illegible] [illegible] in that sentient practices form its substantively (Lazar[illegible] and Vrechopoulos, 2014). This insight comes from the ideological ecologist’s heritage. Mineral wealth and natural ecosystems are typically assumed in PES assessments, but it is critical to consider how they are perceived, appreciated, and represented by various social stakeholders. Although PES developers may observe liquid as a manufacturing insight that needs to be tried to justify between multiple users, rural areas may perceive water as a [illegible] good that plays a crucial role in history and culture. Ritual practices as well as social identification (S. Y. Barykin et al., 2020), because they underlie distinct narratives and reactions, these many aquatic images are crucial. It’s possible to ignore the societal and political context of water shortage by treating it as a natural occurrence without considering its assessment and representation. Reacting to need by questioning its definition and underlying causes puts too much emphasis on technical solutions, such as water supply systems or privat[illegible] flood control, and undervalues the importance of better allocation of resources, managerial staff, and democracy in this context (Marmolejo-Saucedo, 2020). Rather than focusing just on resource planning, we should consider how power dynamics are reflected in humanity’s greatest creation, how solutions are conceived and executed, and the resulting effects on society and the environment(J. Y. Chen et al., 2021).

To understand ecological governance and management, a social-ecological viewpoint points out that these practices are not objective and practical endeavors that seek to achieve a ’common good, but instead practices influenced by and reflecting the interest of those involved(Golosnoy et al., 2019). Key issues include: Who uses the commodities at risk, under which frameworks are they handled and administered, how such frameworks are rationalized, what modifications do they make to social systems and geographies, and who stands to benefit or otherwise? There are several ways in which natural capital administration and preservation efforts may be seen as (material and discursive) conflicts between various social actions aiming to gain control of the resources(DILANCHIEV & TAKTAKISHVILI, 2021).

Finally, environmentalism reveals that the traits and activity of the environment play an important influence in social interactions. PES schemes provide for the definition and treatment of ecological systems as marketable products, at least in theory(Burroughs and Burroughs, 2020). Theoretically, this is possible, but in reality, it ignores the fact that not all kinds of environments give themselves to such dynamic being applied(Podvalny et al., 2017). The ’uncooperativeness’ of water concerning privatization, as shown by, may be attributed to its physical properties and symbolic implications. Because they are hard to prove and quantify, ecological services pose similar challenges: A absence of data about their functions, limits, and levels makes it challenging to establish causation-effect links(Tiep et al., 2021). Although it’s tough to define PES, this current debate illustrates this(Pinto et al., 2019).

Thus, an ideological ecologist’s approach to a study of PES projects will indeed concentrate on how they portray ecologies. They are fully operational, how they describe preservation aims and outcomes(Chang et al., 2022), how respect environmental providers and integrate their involvement, and how they approach ecologic providers(Irfan et al., 2021). When it comes to promoting economic growth, commerce is overall a good and major factor. By generating pollutants or consuming natural resources, the increase in trade activities may directly impact the environment. Similarly, the contamination hypothesis suggests that trade liberalization might result in environmental deterioration if environmental strategies differ across nations. According to a study by (Batool et al., 2022), international trade has substantially influenced the ecological footprint of ASEAN nations from 1991 to 2016. Trade opening may have reduced environmental deterioration over a lengthy period in 16 EU nations, according to another research.(Ahmad et al., 2020). According to, Portugal's economy has benefited and suffered from trade liberalization. That research, on the other side, did not look at the effects of the merchandise trade on the ecosystem. The ecological impact of international commerce has been the topic of numerous studies, but none explored the link between goods trade and the ecosystem.

For the first time, it is possible to estimate a person's biodiversity and environmental consequences by negotiating contracts with the many mineral wealth impacted by human activity (such as fish and farm yields), particularly with land groupings (such as fishing areas and farms). Pakistan's ecological impact per person protects six different land types under these conditions. That Pakistan's embodied energy is dominated by carbon emissions, which make up 50percent of the entire footprint. Carbon output outputs accounted for a larger percentage of Russia's carbon impact than any other land type between 1963 and 2016 (Y. Zhu et al., 2021). Nevertheless, the deciduous forest, built-up land, fishing grounds, and grazed assessment in the same year grew by 11%, 5%, 3%, and 2%, correspondingly. Additionally, agricultural footprint emissions ranked second in Pakistan's overall environmental cost in 2018 at 32%. A large swath of the 73percent agricultural footprint is taken up by the food (Jena et al., 2021).

Varied cultures have various perspectives on KE and the advantages it may provide, according to the research on the exchange of knowledge. Different cultures have diverse ideas about what makes up [illegible] knowledge base and what things may go into building it(Ul[illegible] et al., 2020). B[illegible] on culture protocols dictate what types of information can be decided to share, how, when, and by whom, based on a variety of factors, such as how Foreign understanding is communicated in formal educational environments and how Indigenous knowledge is more commonly decided to share verbally as the portion of other traditional practices. On the other hand, how much an individual or a group can profit from new information and KE relies on their ability to adapt to new situations(Sun et al., 2019). KE's potential advantages may be reaped only if the intellectual property of people who contribute their information is adequately protected by legal regimes worldwide (Fargnoli, 2020). A more in-depth assessment of the research on past knowledge exchange is provided in the accompanying resources. No person to our understanding has attempted [illegible] evaluate the well-being (especially human well-being) advantages of KE associated with natural resource development – common parlance, to assess the path that KE impacts life in general in addition to differentiating between the positive and negative effects of KE on Indigenous peoples(Molla et al., 2019). Research on "wellness" is extensive, with the most important finding suggesting that it can be quantified in various approaches using a range of measurements. Objective measures (such as money and education) are often used in studies, with some stating they are better than subjective criteria of very well. Concrete indications, on the other hand, are generally chosen based on practical considerations (such as data availability) and subjective preferences. A biased decision-making procedure is involved in the selection of objective standards(Durán-Romero et al., 2020). Objective measures may also omit important contextual elements that affect the connections among objective criteria and very well. Further (Accastello et al., 2019). Thus, we concentrate on the personal ego relationships between KE, life quality, and fundamental components of the well.

The dynamical link between trade and environmental deterioration is a hotly debated subject, with many differing viewpoints. According to several studies, financial progress promotes environmental degradation by allowing smog capital and power equipment importation. Several other academics believe that lowering investing barriers leads to environmental degradation due to the increased company expansion and energy requirements that financial growth engenders. There are several techniques for advancing markets, institutions, expertise, depth, and accessibility in the growth of financial institutions in any nation. Economic growth relies heavily on a well-developed financial sector, which enhances ecological responsibility. To analyze the relationship between Qatar's established financial systems, production level, the relationship between economic growth, and environmental cost, used the Markov switching ecological correction model (MS[illegible]M). The findings looked at whether or not there was a long-term correlation between 1969 and 2016 for all factors. According to the empirical data, a two-way causal relationship was found between output level and environmental footprint, as was a one-way relationship between financial issues and environmental footprint. According to (T. F. Walther et al., 2019), Sustainability [illegible] the environmental deficit were influenced by energy usage, economic expansion, and financial progress between 1952 and 2007. According to the data, the financial industry has a major impact on carbon emissions. Furthermore, they found that China's economic growth did not impair its natural resources.

A vast amount of literature links financial advancement with ecological harm. However, there are conflicting results from research conducted in poor and developed nations. For example, several empirical studies have shown that a well-developed financial system considerably [illegible] harmful emissions, and therefore, it protects the green environmental quality(Yarovaya et al., 2020). Various studies have shown that economic growth has the opposite effect, leading to increased pollution. Some studies have shown a negligible link between increasing financial wealth and worsening environmental conditions. Many studies have shown that the financial sector of the United Kingdom (UK) may assist companies in achieving economies of scale and overcoming planning restrictions throughout the production process, resulting in reduced carbon emissions. In fact, according to the research findings, it might make it easier for outdated and polluting businesses to be imported, posing a risk to environmental Sustainability. To get a clear image of the reality, existing literature yielded confusing and contradicting results, needing more research.

3. Theoretical framework, methodology and data

3.1. Theoretical framework

Natural resources, global trade, and widely dispersed energy use in the ten European economies are examined in this research. Based on the notion of long-run economic growth, the link between Carbon dioxide emission, natural resources, and economic globalization is supported by the theory of the output cycle. The ecological modernization hypothesis was initially proposed by (Alam et al., 2019) founded on the principles of how modern industrialized civilizations respond to environmental problems. A limited supply of non-renewable resources exists by nature. Still, the quick pace of production and expansion diminishes the supply and harms the ecosystem due to poor pollution regulations. According to the Output cycle, the ecological environment is intimately linked to economic development and the extraction of natural resources(F. T. Walther et al., 2019). Globalization's "endogenous growth" hypothesis claims that economic globalization aids nations in attaining long-term economic development while also protecting the environment. However, excessive mining and extensive use of natural resources may worsen environmental degradation(Umar et al., 2021). Economic growth in the ten European countries area is heavily dependent on the availability of natural resources, which may reduce the consumption of fossil fuels (Umar et al., 2021a).

Natural resource extraction processes may be impacted by economic globalization, which is connected with the efficient transmission of knowledge. Moreover, environmental contamination may be caused by the multiplier impact of commerce and international investment in unclean technologies. The export of natural resources is the primary source of revenue for the European area, making economic globalization essential. As a result of economic globalization, many nations are significantly reliant on importing the gear and equipment needed for resource extraction and other necessities from other areas of the globe to meet global demand. Economic expansion necessitates the consumption of resources, leading to environmental damage. Consumption and production of resources have a negative impact on the environment and contribute to waste. The demand for housing, transportation, and energy may cause all rise due to urbanization, driving the use of fossil fuels and increasing Emissions of carbon dioxide. But mass transit systems like trains and buses may help reduce pollution levels in metropolitan areas. We are modeling Greenhouse gasses from natural resources, economic globalization, and differentiated energy use, as depicted in Equation (1).

$$CO_2 = f(NR, EG, RE, NRE, UR, Y) \tag{1}$$

For econometric investigation, the model's parameters are log-transformed to smooth out the data and enhance the macroeconomic features of the variables. Data with autocorrelation and variance homogeneity may be cleaned using the natural log transformation. Compared to results from linear combinations, those from data algorithms are more efficient and reliable (Umar et al., 2021c). The log-linear form of increased carbon dioxide emissions is seen in Equation (2):

$$lnCO_{2i,t} = \varphi_0 + \varphi_1 lnNR_{i,t} + \varphi_2 lnEG_{i,t} + \varphi_3 lnRE_{i,t} + \varphi_4 lnNRE_{i,t} + \varphi_5 lnUR_{i,t} + \varphi_6 lnY_{i,t} + \varepsilon_{i,t} \tag{2}$$

Natural resources are one of the only uncontaminated and pure ecological energy supplies capable of meeting the present and future energy needs from natural resources to reduce the negative environmental impoverishment. Natural resources therefore are expected to have a negative impact on CO_2 emissions. Environmental quality is also critically affected by economic globalization. Globalization harms air quality, which helps reduce environmental pollution. (Umar et al., 2021b). Economic globalization is predicted to influence carbon dioxide emissions if this theory is correct negatively. Avoiding ecological damage necessitates the use of clean, renewable energy. It can meet environmental and energy demands since it is a less polluting sustainable source. Despite this, certain types of renewable energy degrade the environment and increases emissions of carbon dioxide. However, the primary determinants of environmental deterioration and environmental warming [illegible] non-renewable energy. According to (Tu and Xue, 2019), industrialization reduces Greenhouse gas emissions. The continuous expansion of production and development in the South Asian economies is a considerable danger to the environment since it leads to environmental degradation. This reasoning leads us to believe that as the economy grows, so will CO2 emissions.

3.2. Methodology

3.2.1. Cross-sectional dependence test

(Symitsi and Chalvatzis, 2019)introduced the Lagrange devised the CD test to quantify CD in panel data. CD inspection is essential in panel data analysis to avoid inaccurate or biased results. The following are the equations:

$$CD = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\widehat{\rho}_{ij}^{2} \tag{3}$$

$$CD = \sqrt{\frac{2T}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\rho_{ij}, \tag{4}$$

3.2.2. Slope homogeneity test

We next looked at the slope homogeneity between the cross-sections after completing the CD test. Panel estimators may be affected by variations in slope parameters due to the differing socioeconomic dynamics of the European nations. Slope homogeneity approach was used. The equations for calculating the parameter estimates are as follows:

$$\widetilde{\Delta}_{SH} = (N)^{\frac{1}{2}}(2K)^{-\frac{1}{2}}(\frac{1}{N}\widetilde{S} - k) \tag{5}$$

$$\widetilde{\Delta}_{ASH} = (N)^{\frac{1}{2}}(\frac{2k(T-k-1)}{T+1})^{-\frac{1}{2}}(\frac{1}{N}\widetilde{S} - k), \tag{6}$$

3.2.3. Unit root tests

After that, the variables' integrating sequence was checked. This difficulty cannot be alleviated by first-generation unit root approaches such as Im, Pes. The CADF unit root tests and the second generation IPS (CIPS) were used because of the CD. The formula for the response variable is as observed:

$$\Delta CA_{i,t} = \varphi_i + \varphi_i Z_{i,t-1} + \varphi_i \bar{C}A_{t-1} + \sum_{l=0}^{p}\varphi_{il}\Delta\bar{C}A_{t-1} + \sum_{l=0}^{p}\varphi_{il}\Delta CA_{i,t-1} + \mu_{it}, \tag{7}$$

Following are some CIPS test results statistics:

$$\widetilde{CIPS} = \frac{1}{N}\sum_{i=1}^{n} CD_i \tag{8}$$

3.2.4. Panel cointegration test

ECM cointegration was employed to study the long-term connection between the regression models, as recommended by (T. Y. Liu and Lee, 2020). Cointegration approaches like Kao and Pedroni's are inferior to this one because it is impartial in the face of homogeneity and CD. This test has two group characteristics and two-panel statistics (i.e. G_t, G_a, and P_t,P_a)). This is the t - statistics calculation:

$$\alpha_i(L)\Delta y_{it} = \delta_{1i} + \delta_{2i}t + \alpha_i(y_{it-1} - \beta_i' x_{it-1} + \lambda_i(L)' v_{it} + e_{it} \tag{9}$$

where $\delta_{1i} = \alpha_i(1)\varphi_{2i} - \alpha_i\varphi_{1i} + \alpha_i\varphi_{2i}$ and $\delta_{2i} = -\alpha_i\varphi_{2i}$.

Is the Johansen cointegration connection between β_i and α_i And is the error correction factor in Equation. The following are the results of the test:

$$G_t = \frac{1}{N}\sum_{i=1}^{N}\frac{\alpha_i'}{SE(\alpha_i')} \tag{10}$$

$$G_a = \frac{1}{N}\sum_{i=1}^{N}\frac{T\alpha_i'}{\alpha_i'(1)} \tag{11}$$

$$P_t = \frac{\alpha'}{SE(\alpha')} \tag{12}$$

$$\alpha' = \frac{P_a}{T} \tag{13}$$

3.2.5. Short-run and long-run analysis

The CS-ARDL model determines the short- and long-term linkages between natural resources, economic globalization, differentiated energy, and carbon dioxide emissions. A vital strength of the CS-ARDL is its ability to deal well with endogeneity, non-stationarity, and CD concerns. For the most part, CS-ARDL looks like this.

$$\Delta EF_{i,t} = \varphi_i + \sum_{j=1}^{p} \varphi_{it}\Delta EF_{i,t-j} + \sum_{j=0}^{p} \varphi'_{ij} AEV_{i,t-j} + \sum_{j=0}^{p} \varphi'_{it}\overline{Z}_{t-j} + \varepsilon_{i,t}, \tag{14}$$

For all explanatory variables, AEV may be found in the cross-sectional means. The AMG approach is used to test the robustness of this study.

3.3. Data sources

Using data from 2000 to 2020, the top ten Asian countries with the greatest gross domestic product (GDP) are analyzed in this study. There are many European countries represented in this group: (Austria; France, Hungary; Iceland; Iceland; Ireland, Germany, Finland, Italy, Spain, and Switzerland). For the chosen period and nations, data from the World Development Indicator (WDI) was acquired in 2021. Solar, hydropower, biogas, and wind power are examples of renewable energy; fundamental energy use before the oil has been distributed is an example of non-renewable energy; and natural resources are represented by the sum of oil, coal, and gas.

4. Results and discussion

4.1. Summary of descriptive statistics

Data points strongly support the high correlation between increases in electricity usage and carbon dioxide emissions at a 1% significance level. According to the experimental observations, there is a bidirectional correlation between renewable energy use and carbon pollution in the high and low tails of the quantile distributed for all nations. This shows that solar power causes carbon emanation and, consequently, renewable energy causes carbon emanation. Similarly (Shi et al., 2[illegible]20), revealed that carbon dioxide emissions and sustainable energy use are linked in a bidirectional causal manner for Thailand and Indonesia.

Table 1 shows the descriptive statistics of each of the three configurations identified in the research. There is proof that FDI and ECI increase in nations with effective institutional strength. Rent prices for environmental assets and sources of renewable energy will fall as public investment rises, the opposite being true(Lea et al., 2017). Countries with weaker institutions are predicted to have good ecological circumstances, while states with stronger institutions are expected to have a worse state of the environment. There is some evidence to back up the argument that Panels A leaves a smaller environmental footprint on the planet and that shifting to Panels C causes [illegible] ecofootprint. The values of kurtosis and skewness have to be [illegible] and three, respectively, for a sequence to be normally distributed. Neither of the factors in any of the panels seems to be typical. Handicrafts created from organic fibers were the second-largest (Abid et al., 2[illegible]21) source of ecological revenue (13 percent), although only 18 percent of primarily impoverished San families engaged in this activity. There was a wide variation in the total annual revenue from food, wild edible plants, and medicinal herbs. Thus, in practice, the contribution to the overall ecological revenue was minor. According to interviews with key informants, handicrafts,

Table 2
Overall results of cross-sectional dependence test.

Variables	Pesaran	Breusch-Pagan LM
[illegible]CO$_2$	25.70* (0.00)	977.12* (0.00)
[illegible]GDP	41.77* (0.00)	1701.39* (0.00)
[illegible]RE	19.61* (0.00)	853.89* (0.00)
L[illegible]	29.76* (0.00)	872.05* (0.00)
LRE[illegible]	8.16* (0.00)	463.58 * (0.00)

Table 1
Descriptive Statistics for 10 European nations (2000–2020).

Sr	1. Carbon Dioxide (metric tons per capita)				2. Total natural resources rents (% of GDP)			
Country	Minimum	Maximum	Average	Std	Minimum	Maximum	Average	Std
United Kingdom	2.51786	7.[illegible]263	[illegible].01197	1.937478	1.047273	9.707333	3.458687	2.297526
France	0.794663	[illegible]98825	[illegible].207877	0.347244	1.727645	7.107894	3.033052	1.33566
Hungry	4.496601	[illegible]82095	[illegible]6744	1.224147	12.67781	34.77639	23.97565	6.337782
Ireland	1.177979	2.[illegible]462	1.[illegible]873	0.277887	2.622529	11.29534	6.688949	2.433826
Iceland	8.607045	9.89[illegible]	9.307393	0.307987	0.017885	0.085974	0.027572	0.012015
Austria	0.6647[illegible]	0.9878[illegible]	0.774884	0.084982	0.757703	2.602692	1.572433	0.552017
Finland	3.08[illegible]8	5.127197	3.877658	0.645265	0.137812	0.665561	0.326367	0.134561
Italy	2[illegible]046	3.85852	3.277603	0.447861	0.697061	3.707723	2.085044	0.849813
Spain	[illegible]907143	12.29459	10.59627	1.263989	0.017425	0.099188	0.023303	0.01773
Switzerland	[illegible].08479	17.64171	14.2707	2.20705	19.87896	55.52531	37.27158	10.93698
Sr	3. GDP per capita (2015 US$ constant)				4. Renewable energy usage (% of total energy usage)			
Country	Minimum	Maximum	Average	Std	Minimum	Maximum	Average	Std
France	1745.4[illegible]	[illegible]1528.29	4857.185	2854.652	12.6355	32.3256	21.3252	6.325852
Hungry	525.3265	1748.665	1524.326	325.362	31.6852	53.76541	44.2988	7.416547
Ireland	3703.476	5612.118	4670.538	625.726	0.5858	1.5254	0.858748	0.232565
Iceland	[illegible]	3452.158	2821.326	585.326	23.6556	51.3258	41.2356	9.365214
Austria	32.32[illegible]	3221.252	3251.859	1847.652	25.6525	41.2658	3.62525	2.326515
Finland	1523.625	1965.3256	1114.325	162.332	39.6352	48.6352	44.2536	4.252527
Italy	6253.252	1214.252	8255.625	2523.545	15.3655	32.6525	16.3258	4.658529
Spain	2563.252	7054.221	5218.689	1145.526	25.6848	26.3565	25.6352	1.636984
Switzerland	1445.636	9693.526	2352.785	6025.365	0.625854	6.35258	1.528565	0.547452
United Kingdom	1124.985	2154.685	1447.627	1524.635	0.0089	0.0285	0.004521	0.006252
Sr	5. Non-renewable Energy usage (kg of oil equivalent per capita)							
Country	Minimum		Maximum		Average		Std	
France	785.3576		3256.652		1854.625		514.5783	
Hungry	485.5285		785.6528		5252.326		81.13189	
Ireland	2152.652		3256.847		36.5458		475.6173	
Iceland	785.6585		958.6325		895.3265		68.68975	
Austria	3965.652		4521.865		665.3254		224.4931	
Finland	525.3654		652.3256		525.7845		17.76774	
Italy	1094.175		1691.361		1829.261		184.4571	
Spain	1073.863		1971.593		1582.828		297.5632	
Switzerland	3377.635		5413.348		4455.307		634.2519	
United Kingdom	4444.969		6905.843		5528.893		840.0653	

bushmeat, wild fruits, and medicinal herbs have cultural importance for the San, notwithstanding their low financial worth (see Table 2).

It is feasible to determine whether or not there exists a long-term link between the study variables based on the fact that the unit root analysis showed that they are all equal to 1. Amongst academics (Ma et al., 2013), co - integrating tests are often used in investigations. Collinearity is the counterfactual of both of these analyses. Therefore it's important to remember that. According to critics, these co - integration tests presume co - integrating vectors to be homogenous over pass units. They are thus unreliable and unresilient if there is a CSD. When CSD is present, the (Q. Zhu and Qin, 2019) cointegration analysis removes those obstacles, resulting in more accurate and efficient findings. This test includes four alternative cointegration tests, two of which evaluate the co - integrating connection over the entire panel, and the other 2, at minimum, inside a certain subgroup of the board. Because of the availability of CSD, the European cointegration analysis is now more important than ever before. For more accurate and consistent findings, this research combines the Kao, Pedroni, and Westerlund co - integration (Chien et al., 2021) test and all of the characteristics of the initial and second phases of these tests. The co - integrating test results showed that the chosen factors have a co - integrating connection (Table 5). Renewable energy consumption can contribute to cleaner environments, according to a broad range of studies, such as (W. Li et al., 2021) that claim this. Our outcomes support this assertion and make renewable energy consumption a significant aspect of ensuring that the environment is cleaner. That's why investment in renewable resources needs a revision of proactive regulation measures in keeping with the present stage of economic growth, where expanding research and development is the main alternative answer. Hence (S. Liu et al., 2017). If we want to lessen our environmental impact, we need to speed up our energy transition, which has significant policy consequences(Graham and Harvey, 2001).

4.2. CSD and unit root test result

As shown by the environmental cost, the long-run panel [illegible]ed model reveals that real production (GDP) has a beneficial impact on energy quality in both the short and long term. For example, a 1% rise in GDP results in a 0.81-percent drop in environmental quality in the short term and a 0.79-percent decrease in the destruction of the environment in the long term. We had predicted a linear link between wealth and environmental pollution based on our previous apriori assumptions (Pachauri and Spreng, 2004). We predict a decrease in environmental degradation (negative connection) in a scenario where wealth is squared (the Environmental Kuznets Curve theory). Most EU nations are increasingly ecologically mindful of their economic trajectory, although other member states are still lagging in attaining important sustainable energy goals(Bonatz et al., 2019). That most EU nations have achieved such significant milestones and reaped the advantages of signing the Kyoto Protocol and other country-specific objectives and energy obligations [illegible] explained further. According to a recent report, most nations reaching their renewable energy goals still have a long way to go compared [illegible] countries that haven't met their goals.

The research shows that moving away from an agricultural economy or towards an industrialized base, expanding goods, and increasing the development and output of nations may pose a serious environmental threat (Mohsin et al., 2021). findings have all been confirmed by these new findings. As a result of this analysis, we can confidently infer that socioeconomic intricacy has the greatest impact on deterioration in all panels. Panel B's carbon impact is much larger than Panel A's due to the greater complexity of the economy. Goods exports are more difficult and (Iqbal et al., 2021) environmentally damaging in nations with greater macroeconomic stability than in countries with lower bank profitability. By strengthening institutional performance at a certain threshold, governments may reduce the negative effect of quantitative methodology on pollution. Intellectual capital, considerable R&D expenditures, and more ecologically responsible technology and emissions reduction procedures may contribute to greater financial intricacy.

However, this result differs from the Romanian case study conducted by (Bouri et al., 2021). Over time, a one percent increase in the percentage of renewable energy used in overall energy consumption causes environmental degradation by around 0.04 percent (this sign indicates far lower environmental damage than 0.98 percent for non-renewable energy consumption). Because the European Union is adhering to the Climate Agreement and Paris Agreement on climate change, this indicates that EU nations are meeting their energy goals. However, we must proceed with caution since we can see that free trade and a rise in fertility rate are both responsible for reducing the destruction of the environment over the long term. This study's empirical data refutes the commonly held belief that high fertility [illegible] the normal nexus of environmental footprints. However, this finding is unlikely [illegible] do with the United Nations Population Fund's finding of variation in fertility rate trends between EU nations. When it comes [illegible] fertility rates, the United Nations Population Fund (UNFPA) has noticed that the southern and eastern European areas (such as Ukraine and Italy) have low fertility rates. In contrast, the north-western European countries (such as Denmark and France) have higher fertility rates. The study's short-term estimate shows a positive correlation between reproduction rate and ecological footprint, although this effect is not significant statistically. Studies of this kind necessitated using the (Okushima, 2019) Panel Causality Test, which is shown in Table 3. We found that actual income directly affected environmental quality for the area studied.

We employ frequency response models and multiple regression to examine the influence of FDI, renewables utilization, industrial complex, environmental assets, and the connection between them (systemic sophistication and environmental assets) on the carbon impact. We may examine one variable's response to the invention of other research variables using frequency response operations in the PVAR framework. PVAR modeling variance decomposition breakdown evaluates the accumulated percent change in one constant fluctuation by some other variable's shocks (Radonjič and Tominc, 2006). First, the PVAR woman's instability must be described to determine if the findings of impulse response functions and multiple regression are resilient and accurate. The PVAR paradigm is stable if all of its eigenvectors are inside a circle. the eigenvectors are all located inside the process, and all herein are in equilibrium. Table 3 shows the results of the 2nd unit root test for CIPS and CADF. There is a non-stationary relationship between the ecological impact, gross domestic product (GDP), value-added industry, the exports of goods, and environmental assets.

However, in both the CIPS and CADF (Cheng et al., 2020) models, urbanization remains stable. This demonstrates that the variables in this research are combined with static qualities, but no one variable is 2nd conditional variance stable. Westerlund's co-integration findings are reported in Table 4 for both the models shown in equations (1) and (2) (Table 4). There are four statistically meaningful findings from the four methods used in the study: Gt (Ga), Pt (Pt), and Pa (Pa). For the 10 leading industrial nations from 1969 to 2016, this study found long-term correlations between the carbon impact, GDP, value addition industry, exports of goods, environmental assets, and urbanization. Production that contributes to economic growth and the carbon impact both grow by 0.19 and 0.22 percent, correspondingly, according to the coefficient value of valuation production. According to this correlation, production physically hurts our environment by expanding our ecological impact by releasing gas, solids, and fluid waste into the atmosphere as a result of production (see Table 7) (see Table 6).

4.3. Results of cointegration tests

The NARDL's short- and long-term coefficients are now the focus of this discussion. The short-term outcomes for the four regions are shown in. Energy generated by renewable sources harms climate change in five provinces. The usage of sustainable power in the Western provinces has been shown to reduce pollution. Renewable energy use has different

Table 3
Results of 2nd generation unit root test.

Test	CPIS Trend		CADF					
			Without			With		
Variable	Without	With	T bar	Z-t Δ bar	P value	T bar	Z-t Δ bar	P Value
LCO_2	−2.75	−2.87	−2.77	0.97	0.74	−1.73	1.37	0.81
ΔLCO_2	−6.54*	−6.18*	−3.51*	−6.78*	0.70	−3.79*	−5.71* 1.26	0.70
LGDP	−0.49	−2.37	−1.74	−0.75	0.41	−1.76	−3.77* 0.92	0.79
ΔLGDP	−5.91*	−5.96*	−2.63*	−3.78*	0.14	−3.77*	−6.66* 1.64	0.14
LNRE	−1.74	−2.23	−1.70	−8.63*	0.58	−2.56	−5.71*	0.87
ΔNRE	−5.18*	6.07*	−4.72*	−6.75*	0.14	−4.77*	−2.79	0.15
LRE	−1.68	−2.74	−1.77	−9.77*	0.69	−1.25	[illegible]	0.97
ΔRE	−5.72*	−5.39*	−3.60*	−2.76*	0.14	−3.75*	−2.71**	0.19
LRENT	−0.31	−2.77	−1.70	−1.62	0.87	−2.93	−0.72	0.07
ΔLRENT	−6.72*	−6.72*	−4.71*	−4.74*	0.04	−4.73*	−4.70*	0.07

Table 4
Results of cointegration tests.

Newey-west automatic bandwidth selection and Bartlett kernel			
Dimensions	Variable	Statistical	Weighted Stat
Within (panel)	V	0.4476 (0.32)	−0.0797 (0.53)
	rho	0.8496 (0.80)	0.4107 (0.65)
	PP	−1.9710*** (0.07)	−4.1479* (0.00)
	ADF	−1.8604** (0.05)	−3.0663* (0.00)
Between (group)	rho	1.4336 (0.92)	
	PP	−7.0774* (0.80)	
	ADF	−2.8998* (0.40)	
Kao Residual Cointegration test			
ADF		T-Stat	Prob
		−5.2708*	0.137
Johansen Fisher panel cointegration test			
Cointegration		Trace	Max eigen test
None		440.3* (0.00)	401.9* (0.00)
At 1		296.8* (0.00)	159.8* (0.00)
At 2		174.9* (0.00)	190.4* (0.00)
At 3		67.69* (0.00)	[illegible] (0.00)
At 4		57.71* (0.00)	56.6[illegible] (0.00)

Table 5
Results of Westerlund's cointegration test.

Statics	Value	Z-value	P-value
Gt	−4.071	[illegible]87	0.09***
Ga	−6.853	1.1[illegible]	0.97
Pt	−4.92[illegible]	−2.50[illegible]	0.07**
Pa	−5[illegible]4	3.091	0.96

effects in these four regions. In Gansu, Qinghai, and Xinjiang, the impact is more pronounced than in Ningxia and Shaanxi. In the same way, a negative shock to renewable sources raises CO_2 emissions(Charlier and Kahouli, 2019). carbon output. Consequently, more hydropower leads to better environmental stewardship, whereas less renewable energy usage leads to increasing CO_2 emissions and worsening climatic conditions.

Non-fossil fuels have a substantial role in reducing CO_2 emissions in 30 Chinese provinces. As a result, the environmental benefits of renewable energy sources may be seen in China's post-reform era. Beneficial shocks in non-renewable energy usage have a significant positive effect on Output in all provinces. This is an example of how greater reliance on fossil fuels leads to contamination of the environment. On the other side, decreases in Dioxide emissions are caused by increases in energy use. As long as the coefficients are not very significant, pollution management will need a sustained effort to find better energy sources than what is now available (Dong et al., 2021). Concluded that non-renewable energy had the most negative influence on environmental quality in the central, northern, and eastern regions. These data support their findings. Only in China's Northern and Eastern regions could alternative sources substantially impact CO2 emissions.

Table 6
Results of PMG test.

Model 1: DV GDP		
Long Run Coefficient		
Empty Cell	Coefficient	Prob
LNRE	1.1676*	0.700
LRE	0.0272**	0.8428
LRENT	−0.1977*	0.900
Error correction coefficients	−0.2746*	0.7000
Short-run coefficients		
D (LNRE)	0.4392*	0.0709
D (LRE)	−0.0678	0.4794
D (LRENT)	0.0073	0.7697
Constant	1.4579*	0.0702
Model [illegible]		
Long Run Coefficient		
	Coefficient	Prob
LGDP	0.3737*	0.001
LNRE	1.2741*	0.002
LRE	−0.2922*	0.0075
LRENT	0.0246a	0.0286
Error correction coefficients	−0.3598*	0.0042
Short-run coefficients		
D (GDP)	−0.0137	0.8854
D (LNRE)	−0.3977	0.3378
D (LRE)	0.4184	0.1907
D (LRENT)	−1.0957	0.1308
Constants	−0.0519	0.1727

Table 7
Results of DCCE test.

Model 1: DV GDP		
Long Run Coefficient		
Empty Cell	Coefficient	Prob
LNRE	0.7540*	0.127
LRE	3.6871**	0.082
LRENT	−0.1798**	0.051
Short-run coefficients		
D (LNRE)	0.2771*	0.081
D (LRE)	0.0779	0.587
D(LRENT)	−0.0951	0.327
Model 2: DV CO2		
Long Run Coefficient		
	Coefficient	Prob
LGDP	2.8781*	0.017
LNRE	0.0547	0.946
LRE	−0.6597**	0.063
LRENT	0.2598***	0.092
Short-run Coefficients		
D (GDP)	−0.998	0.247
D (LNRE)	0.9474	0.068
D (LRE)	−0.1067	0.832
D(LRENT)	−0.1579	0.289

Growing economic growth is also linked to increased CO_2 emissions due to increased energy use. Positive GDP coefficients point to a short-term decline in the natural ecosystem across all regions. Negative shocks, on the other hand, reduce CO2 emissions. Economic growth in China's less underdeveloped Northwest area has a major impact on CO_2 emissions.

4.4. Results of PMG test

A decrease in CO_2 emissions is also connected with positive shocks in the transportation sector. As a result, the mobility industry's increasing energy use harms nature. There is a significant reduction in CO_2 emissions across all provinces due to the positive delayed shock from renewable energy. In contrast, the postponed variables demonstrate that reduced renewable energy use in Gansu and Qinghai has an immediate negative impact on the environment. Ningxia, Qinghai, and Xinjiang's groundwater pollution is exacerbated by the positive lagging effects of non-renewable energy. The reduction in pollution in Gansu, Ningxia, and Shaanxi is linked to adverse feeling shocks(Kyprianou et al., 2019). A rise in CO_2 emissions accompanies Gansu, Ningxia, and Xinjiang economic growth. On the other hand, volatility has a distinct impact on emissions in various parts of China. As a result, Gansu, Qinghai, Ningxia, and Shaanxi negatively influence the environment regarding packaging. Conversely, the adverse shocks imply that Emissions of co2 in Gansu, Qinghai, Ningxia, and Xinjiang will fall at varying degrees of importance in the near term. The Chinese government's intensified attempts to minimize renewable energy contamination may be seen in this crucial relationship between the environment and energy growth. The economic and environmental benefits of increasing reliance on renewable energy sources cannot be overstated. Renewable energy investments in China account for a third of total worldwide assets, and the country's 13th development plan calls for an increase of 39 percentage points in renewable power. It is a concrete illustration of China's government's attempts to reduce CO_2 emissions.

Pollutants in China have overtaken those in the United States due to the country's rapid economic growth, and the government has pledged to reduce emissions significantly. China agreed to cut CO2 emissions by up to 90 percent by 2040 as part of a joint discussion with the United States on global warming. Achieving this aim via environmentally friendly growth was China's next step in the process of social change. In the recent future development, the government emphasized reducing carbon emissions and established various goals for each area. Each area has a different emissions reduction goal depending on the province's economic growth. From 201[illegible] to 2018, affluent countries were given six percent more CO_2 emission reduction objectives than developing countries(Jamali et al., 2021). As a result of this campaign's focus on long-term returns, there is a greater level of uncertainty. As a result of government funding and dedication, alternative energy usage has resulted in lower pollution levels than in the preceding decade in several provinces. The Chinese state attempts to accelerate progress have resulted in a significant relationship between sustainable power and pollution management. ARDL positive and negative long-term dynamics are summarised in.

By using natural resources efficiently, we may minimize our environmental imprint and boost economic growth by 0.02% and 0.12%, correspondingly, according to the net negative of the ecological resource factor. The fact that natural (X. Liu et al., 2021) capital richness is negatively correlated with carbon impact shows that a larger concentration of environmental assets is better for the ecosystem. While the link between the environmental economy and financial development supports resource poverty, an excess of ecological assets inhibits economic growth. Financial development is affected by both the consumption of natural resources and their decline, which is a double-edged sword. An economic problem occurs when a country has excess non-renewable environmental assets. Yet, economic growth stagnates or even decreases when the country concentrates its output on one sector, such as petroleum or mines, and ignores development in other important industries. Expansion of resource extraction causes environmental damage such as soil pollution, droughts, species extinction; the loss of ecosystem functioning; and global warming, all of which result from the increased extraction of raw materials. A wide range of businesses, from farming to mines to forests to fisheries, all rely on natural resources such as land, river, vegetation, or soil. Results like these are similar to the findings of(J. Li and Yan, 2020).

A one percentage increase in urbanization may boost the ecological footprint by 1.5 percent and economic expansion by 1.4 percent. Growth in urbanization's carbon impact is connected to the rise in energy consumption, infrastructural development, waste disposal issues, and so on, which affects the environment (Pramborg, 2[illegible]). Demand for natural resources is growing, and this imbalance is being exacerbated. As a result, urbanization is directly linked to issues including excess energy use, transport, transportation, refrigerators, and forestry. Even more disturbing is that people living in cities use far more resources than those in the countryside, leading to environmental degradation and a decline in the level of life for the urban population(VOS [illegible]TTANEO, 2021). Economic expansion is positively correlated with a boost in the number of people living in urban areas, which implies that a greater concentration of people residing in densely populated areas will also result in a rise in the per income per capita that will enable them to take advantage of newer technologies, enhanced quality, and higher living standards. In addition, urbanization has a good impact on the research & development [illegible] that contributes to the technical advances that encourage development and growth (B[illegible]uri Ahmadi et al., 2017). The literature supports these findings(Mohsin et al., 2020).

For the benefit of Qinghai and the surrounding provinces, this transition toward utilities such as electricity is a boon. This has led to a fast expansion of renewable energy production in Gansu province, a critical [illegible] region. One of the world's giant wind farms is located in this province. Gansu is one of the most significant regions in terms of hydropower because of its wind power-producing capability. In addition, the high altitude of this region provides a wealth of solar and wind power. By producing clean energy and making progressive use of the existing resources, these provinces can lessen pollution. While Shaanxi and Ningxia have made some progress in using renewable energy, the effect on pollution reduction is minimal, they are still trailing behind their neighboring provinces in this area. There is still a lot of reliance on fossil fuels in this province. Shaanxi has a lower percentage of its population using renewable power than other provinces (Njiru and Letema, 2018). A greater emphasis should be placed on promoting renewable energy sources by municipalities in both provinces.

(Yang et al., 2021) Found comparable long-term correlations between China's GDP, CO_2 emissions, renewable and conventional energy output, and international trade. Several recent studies found that although fossil fuels increase pollution, sustainable and nuclear energies had the opposite effect. Furthermore, alternative sources have a more significant long-term impact on reducing Carbon footprints than atomic power. It's interesting to note that some of these variables' long- and short-term relationships are pretty similar. To be more precise, the effect of negative surprises varies dramatically across all parameters for all provinces. Short-term shocks tend to be insignificant, but the long-term relationship and impact are essential. Cleaner production rules and limits need time to adapt, and results may usually be seen after a fair amount of time. This is the economic basis for the differences(Thomson et al., 2019).

In nations with differing degrees of financial development and economic growth, the impact of environmental assets on the carbon footprints varies and is insignificant. Renting mineral wealth has a detrimental effect on nations in panel A's ecological footprint. Natural capital rent is often greater in these nations (Jiang et al., 2019), which may enhance the quality of the environment by bolstering the sector of renewable energy, as previously indicated. However, in Panel B nations, resource rents pose a serious risk to the environment and have a severe influence on the concerning environmental quality. Over-reliance on environmental assets diminishes biodiversity since environmental habitats cannot be recovered as soon as they are used. Rent prices from environmental assets have a detrimental effect on ecological integrity, which may be mitigated by enhancing institutional performance (Panel C). Reducing a country's reliance on natural capital sales income while increasing its capacity to oversee mineral wealth, build an effective infrastructure, and produce a healthier environment are all benefits of improving institutional performance. Comparable to(Swanepoel et al., 2019), the practical impacts of natural oil revenues on air sustainability are similar. In contrast, research has shown that mineral wealth harms integrity(Fornell and Larcker, 1981).

Our research attempts to clarify the impact on the environmental cost of the connection between economic intricacy and natural capital prices. The ecological environment in all three configurations can be improved by transferring natural capital rent to more complex and complicated goods, which have a detrimental impact on the economy's complexity. Resources leases may be used to fund infrastructure upgrades and R&D operations that are essential to the creation of cutting-edge goods while also reducing the planet's environmental imprint.The GMM estimation technique is used in this work. Hence the Hansen-J test for over-identification is used to determine the resilience and efficiency of the PVAR models. The Hansen-J test is a specification test for assessing when overidentifying constraints are legitimate and resilient. The PVAR woman's stability and validity are shown by Hansen-findings. To put it another way, the valuation sector has an enormous influence on our economic and economic development by creating more things and activities for us to consume. This shows that the manufacturing industry has a lot to offer the economy but also a lot to worry about in terms of pollution and deterioration. Poor pollutant management and prevention have various causes. Many small and medium-sized businesses (SMEs) fail because of a lack of skills, a lack of capital, and a lack of technical skills. Additionally, a weak regulatory climate and a lack of monetary and political incentives are to blame. For instance, the use of metal, polymers, solvents, and fossil fuel extraction in manufacturing contributes to environmental damage(Hair et al., 2017). Because [illegible] fossil energy, companies were capable of constructing larger and more adequate facilities that exacerbated ecological damage(Guo et al., 2017), all found similar results.

A rise of one percent in merchandise exports in the top ten manufacturing economies boosts the environmental impact and economic expansion by 0.20 cent and [illegible]032 percent, correspondingly, with a particular benefit of the goods trade coefficient. The correlation between goods commerce and the carbon impact demonstrates that trade growth harms the environment. According to these findings, a trade balance increase may significantly harm the environment by generating pollutants and destroying resources. Commodity liberalization may also result in nations specializing (Treiblmayer and Sillaber, 2021) in polluted air industries. As a result, a nation's capability to manage the environment efficiently may be strengthened through facilitating growth, progress, and welfare programs via expanded merchandise trade in the latter. In addition, open markets may facilitate new technology [illegible] that can reduce the usage of resources such as freshwater and ecologically damaging compounds in regional production processes. As a result, goods trade may positively impact GDP and business output. Economic growth, on the other hand, is a danger to the sustainability of the environment. According to, as well as(Humphrey et al., 2020)., this finding is also following previous research.

Analysis of Dioxide emissions in four regions is carried out using the dynamic multiplication analysis. The best-fit NARDL model was used to determine the passionate exponent. Alternative sources, GDP, non-renewable use, and transportation all positively and negatively impact CO2 emissions(Drescher and Janzen, 2021). The asymmetrical curve shows differences in dynamic multipliers linked with all causal factors (green line). Using the 95% confidence interval, the dotting trim purple and brown lines depict the lower and higher bands. Gansu province's results are. The dynamic multiplier shows that alternative sources have both a short-term and long-term impact on CO_2 emissions. Energy consumption has a tremendous effect on nature in both good and negative ways.

5. Conclusion and policy implications

According to this research, the relationship between non-renewable and renewable energy consumption, economic recovery and carbon dioxide emissions in 10 European nations based on their biggest GDP from 2000 to 2020 was examined in detail. The long-term relationship between the selected countries was validated by conducting three different cointegration tests. The pooled mean [illegible] technique was also employed to explore the long-term demand elasticity of the two models. In the beginning, we looked at the long-term relationship between the use of natural resources, non-renewable energy, and GDP. According to studies, renewable and non-renewable energy usage boosted economic growth in several countries. Natural resources also hampered long-term economic advancement in [illegible] countries in the past. Second, the long-term impact on carbon dioxide emissions, natural resources, economic recovery, and the use of non-renewable and renewable energy sources was measured in this study as well. According to the findings of all three research panels, environmental quality was degraded due to natural resources and economic recovery. In addition, research has shown that renewable energy decreases glasshouse gas emissions in countries. While countries' CO_2 emissions were affected by natural resources, the region's ecological environment was improved.

In light of the recent findings, there are a variety of policy recommendations. To improve environmental protection, authorities should, for example, promote renewable energy sources such as wind, solar, thermal, and biomass. To maintain economic development, governments [illegible] also support ecologically beneficial activities. But lawmakers should be wary of NR's executives. NR's participation in economic advancement is best achieved by reducing devaluation and increasing educational attainment. It's possible that in certain Asian countries, natural resources are seen as a deterrent to economic development. Yet, they may be an excellent foundation for financial development if used correctly by public authorities. Analysts remarked that the Asian area supported trade and improvement and massive stars in the urbanization process in the European region. They are the driving force behind industrialization, and each nation has successfully linked with global oil and gas organizations throughout discovery, creation, and appropriation.

Instead of using available natural resources, horticulture, fishing, or carbon impression but rather the outflows of CO_2 generated per person, we rely on per-capita Carbon dioxide emissions. Natural quality intermediates may be used in the future to examine how the findings alter depending on the distribution of information. Furthermore, we missed out on several countries owing to a lack of knowledge. The following analysis will look at the nations that have fallen out of favor due to a lack of easy access to information. In addition, a polynomial or cubic capacity might be used to examine the EKC theory to check better the relationship between sustainable development and environmental quality in each country and to develop more accurate laws that can lead us to improve our environment.

Ethical approval and consent to participate

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. We declared that we do not have human participants, human data, or human tissue.

Consent for publication

We do not have any individual person's data in any form.

Author contribution

Dong Meng: Conceptualization, Data curation, Methodology, Nadeem Iqbal: Writing - original draft. Visualization, Shaodong Zhao: supervision, editing, proofreading.

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