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Edited By
Dr. Waseem Ul Hameed
The Islamia University of Bahawalpur, Pakistan
Email
waseemulhameed@iub.edu.pk

Reviewed By
Dr. Muhammad Farhan Basheer
University of Lahore, Lahore, Pakistan
Email
khwaja.farhan7@gmail
Dr. Tamkinut Rizvi
Univeristi Utara Malaysia, Malaysia
Email
amkinut.rizvi@oyagsb.uum.edu.my

Correspondence
Mohsin Ali, School of Economics Finance & Banking, Universiti Utara Malaysia, Kedah, Malaysia.
Email
mohsinpak@yahoo.com

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The Nexus between, Trade Openness, Foreign Remittances, Public Awareness, Energy Consumption, Economic Growth, and CO_2 Emissions in Industrialized and Emerging Digital Economies

Muhammad Naeem Shahid[1], Erum Fatima[2], Hassam Gul[3], Mohsin Ali[4*]

Abstract

The purpose of this study is to investigate the relationship between remittances, public awareness, trade openness, CO_2 emissions, energy consumption and economic growth in a panel of industrialized and emerging digital economies 2023 sought to fill this void. There is inconsistency and insufficient investigation into the connection that exists between public awareness, carbon dioxide emissions, and export earnings. The study used the co-integration approach developed by Wester Lund and Edgerton, Cup-FM, and CUP-BC, as well as the generalized quantile regression approach and second-generation unit root approaches for long-term estimation. As well as unit root approaches of the second generation. The findings demonstrate that remittances contribute to halting environmental damage because they have a negative effect on emissions in emerging digital economies. Energy contributes to the reduction of emissions in a manner that is comparable to how trade openness reduces CO_2 emissions. On the other hand, economic growth encourages environmental degradation. The study also suggests that public awareness plays a significant role in encouraging environmental degradation. In light of these groundbreaking findings, a number of policy recommendations are offered. While economic expansion is linked to the deterioration of the environment, trade openness and the utilization of energy also contribute to the reduction of emissions. Public awareness plays a significant role in encouraging environmental degradation.

Keywords: Emerging Digital Economies, Public Finance, Financial Development, Trade Openness, Several Policy Recommendations, Energy Consumption.

1. Introduction

As the negative effects of environmental degradation, such as climate change and global warming, become more evident, environmental awareness increases worldwide and nations are compelled to take action to lessen this destruction. Legislators find it difficult to quickly implement environmental regulations due to the inevitable degradation of the environment brought on by economic expansion. As a result, while policymakers continue to look for environmental measures that have the least negative effects on economic indicators, economists focus their research on the connection between macroeconomic and environmental statistics. Because the industry structure and, as a result, the economy of many nations are primarily based on carbon fuels, the aforementioned searches are typically feasible with the effective utilization of resources and the transition from non-renewable sources, especially in emerging digital economies.

In this Figure 1, perspective, the carbon emission is constantly increasing from 1970 to 2020. There is a small reduction of carbon emission during bigger events happen in economies such as collapse of Soviet Union in (1989–1991), grand financial crises (2007–09), affected the global emissions curve, but only as short-lived dents, suggesting that economic crises do not have an important effect on global CO_2 emissions. Moreover, The Covid-19 crisis, which caused a recession in 142 countries and reduced the global GDP by 3.2% in 2020, reduced CO_2 emissions by –5.9% in 2020, followed by a rebound of 5.6% in 2021 (bp, 2022). Figure 1 depicts that CO_2 emission not effected with economics, political and regime changes events.

Authors Affiliation

[1] Lecturer, Business Administration, Cholistan IBA, Cholistan University of Veterinary and Animal Sciences, Bahawalpur, Punjab, Pakistan. Email: naeemshahid@cuvas.edu.pk
[2] Lecturer, Department of Management Sciences, DHA Suffa University, Karachi, Sindh, Pakistan. Email: efatima@dsu.edu.pk
[3] Association PhD Scholor at DHA Suffa University, Pakistan. Email: hassamgul20@gmail.com
[4] School of Economics Finance & Banking, Universiti Utara Malaysia, Kedah, Malaysia. Email: mohsinpak@yahoo.com

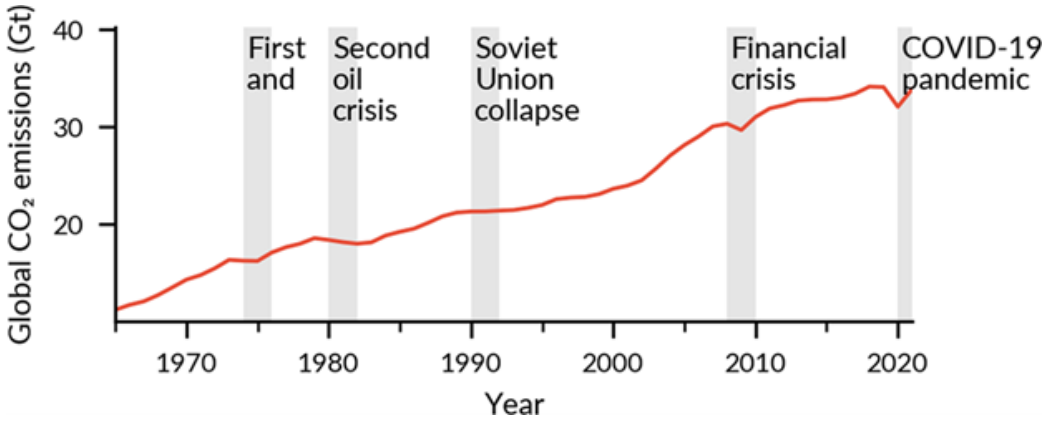

Figure 1: Global CO_2 Emissions from Fossil Fuel Combustion. The Grey Shades Represent the Five Biggest Economic Crises in 1965–2021.
Source: (bp, 2022).

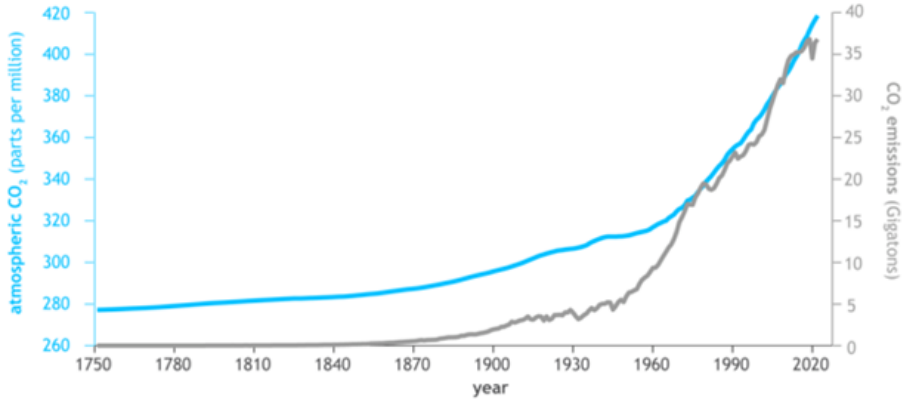

Figure 2: Atmospheric Carbon Dioxide Amounts and Annual Emissions.

It is obvious from Figure 2 that the level of CO_2 emissions has significantly increased over time. In particular, the amount of CO_2 emitted each year has increased from 5 billion tons in the middle of the 20th century to 35 billion tons in 2021. Furthermore, the level of CO_2 in the atmosphere has increased as well, rising from 280 parts per million (PPM) in 1750 to 420 PPM in 2021. This shows a 50% increase throughout that time. The Industrial Revolution (industrialization) is the main contributor to this rise in CO_2 emissions and concentration. The onset of the industrial revolution resulted in a remarkable transformation in how society functions, with individual nations frequently undergoing profound socioeconomic upheavals.

In the current era of technical advancement, the financial sector is viewed as a crucial resource in funding ecological expenditures due to the high cost of developing new technologies. Additionally, for nations that favor using public funds to pay environmental expenditures, the Official development assistance is the most important resource. Nevertheless, there are arguments against finance that claim these subsidies drown out the economy and bloat the private sector. Remittances are now being underutilized essential resources. Remittances help lessen environmental degradation because they are one of the foundational parts of the global monetary sector. Research on the link between remittance-environment are scarce since the effects of transfers on the environment happen indirectly through several channels (Guo et al., 2023). The first route is made possible by the rise in remittances, which raises individual disposable income. On the one hand, rising personal affluence results in more energy-focused consumption, which worsens the environment. On the other side, the rise in personal income encourages the creation of new jobs and boosts output. Environmental effects of economic expansion brought on by increased production vary depending on the state of the economy. The second channel deals with how remittances affect consumption. Consumption growth is accompanied by output expansion, and as a result, energy demand rises sharply.

1.1. Environmental Pollution

As a result, it is anticipated that environmental pollution will rise in tandem with rising energy demand. A third route becomes available as more money moves from repatriation to the banking sector. This conduit's impact on the environment is also unknown, which is unfortunate because studies of the effects of financial activities on the environment typically yield complicated results. Numerous ecological and remittance-related factors have the potential to deepen the complex connection that exists between the two (Ren & Zhao, 2023). For instance, it is said that individuals can improve their public awareness attainment by making use of the gains from personal income increases brought on by remittances (Uralovich et al., 2023). As a result, having a higher public awareness level can lead to a better understanding of the environment, which may help reduce the activities that contribute

to pollution. Foreign trade is often overlooked as a potential market (Ma et al., 2023). Because of the transfer flow, the overvalued Canadian dollar could hurt the country's ability to compete in international trade by bringing attention to the issue of public moral hazard and reducing the range of exports by having a negative impact on domestic game (Aljadani et al., 2023). The fact that Trade Openness is a representation of a nation's commerce architecture or even developmental structure emphasizes the significance of this indicator's environmental impact. Last but not least, because countries with underdeveloped banking systems rely heavily on remittances for financing, supporting projects specifically focused on the development of energy sources reduces the negative environmental effects of remittances (Wang et al., 2022a). Due to the intricate connection between all of these channels and environmental indicators, we must determine how transfers affect the environment.

As a result, an acceptable environmental policy could be developed for the countries under investigation. The central objective of this article is to determine the environmental impacts Trade openness, foreign remittances, Public Awareness, energy consumption, economic growth for the emerging digital economies (Hung, 2024). The effects of economic growth, job opportunities in more developed countries, public awareness, and the use of energy on CO_2 emissions are also investigated. The contributions of the study to literature are as follows: i) this research is the first of its kind to look at how the environment and foreign remittances interact in the nations; ii) The examination also improved through public awareness, international trade, and energy; iii) The panel data method utilized in the study yields more reliable outcomes because it takes into account the possibility of reliance between the countries under investigation; iv) It also uses its quantile regression analysis to make policy recommendations that are more in-depth and robust.

2. Overview of Existing Literature

The majority of the research that has been done so far has looked at trade Openness through either diversification through imports or exports (Uche et al., 2023). Foreign remittance has also only recently been used by scholars to describe how the environments of the destinations differ from their own (Chen et al., 2023). This paper thus contributes to the expanding body of literature by including both repatriation and variation in international trade in its analysis of environmental quality (Li & Yang, 2023). The environmental explanation of environmental pollution based on the pollution haven theory and the ecological Kuznets slope (Hsu et al., 2023). However, the study only examines a small portion of the literature.

2.1. Nexus between Trade Openness and CO_2 Emissions

Herfindahl fixation and Theil List are commonly used to appraise the product/import expansion for every country. Since the Theil index is inversely related to the quality of trade flows (EX) in an economy and has demonstrated that rich countries' imports and exports are typically more diverse than those of emerging countries (Aljadani et al., 2023; Zafar et al., 2022), a lower (higher) Theil index indicates a higher (lower) level EX. The environmental Kinked Demand Curve Hypothesis was applied to data from 1998 to 2016 countries Moghaddam and Kunst (2023), and Tucker (1995) used a sample of 98 advanced and developing nations to experimentally test the association between EX and CO_2 emissions. Overall, relatively little work has been done to compare EX to environmental quality. In twenty emerging nations, the findings demonstrate that Trade Openness raises CO_2 emissions. However, it must have been discovered that the EX could help industrialized economies reduce CO_2 emissions (Al-mulali & Sheau-Ting, 2014; Do & Burke, 2023). The findings indicate a scale effect that is significantly more significant for developing nations than technology or compositional effects (Zambrano-Monserrate et al., 2018). These findings about the quality of the environment are in direct opposition to the overall policy recommendations that EX makes to developing nations. EX and public Awareness were also examined in relation to the energy demand of the US economy. By revealing a long-term relationship between public Awareness, energy needs, and EX, their findings demonstrate that EX and public Awareness are both inversely correlated with energy demand. Mania (2020), which demonstrated that EX reduces CO_2 emissions for industrialized nations, concurs with this finding. Data model used a panel of 19 advanced markets from 1962 to 2010 to determine that the Zendehboudi et al. (2013) EX has a lower impact on the environment. Recently, EX, extensive, and intensive margins were examined in relation to energy economies' energy demand. As a result, similar outcomes can also be expected. They found that EX reduces overall energy consumption. Utilizing different EX markers, Bashir et al. It was also looked at how EX affected energy use and emissions in OECD countries. The analysis shows that all EX-indicators should reduce energy intensity strongly. Contrary to the majority of research, Wyatt et al. (2014) discovered that EX was linked to an increase in CO_2 emissions.

2.2. Nexus between Foreign Remittance and Carbon Emissions

Despite studies examining the effects of overall economic factors like direct investment payments and international aid on the environments of recipient nations, foreign remittance in environmental damage have only recently been recognized (Galvan et al., 2022). One illustration is the study of the indirect environmental effects of foreign remittance on six Asian economies (Mohsin et al., 2022). Foreign remittances were found to have a positive long-term correlation with CO_2 in Bangladesh, India, Sri Lanka, the Philippines, and Bangladesh (Wang et al., 2022b), but not in China or India. Similar research examined how foreign remittance affected the Chinese economy between 1980 and 2014. Additionally, their findings demonstrate that foreign remittance do in fact contribute to environmental pollution. They used the non-linear ARDL method. In addition, the Nepalese economy's exports, wealth creation, and foreign aid were examined in relation to CO_2 emissions.

2.3. Nexus between Public Awareness and Carbon Emissions

People's actions have a significant influence on energy use and carbon emissions. Several nations have started looking for new development pathways that have been heavily marketed for low-carbon communities in order to efficiently cut carbon emissions while maintaining digital economic growth. In actuality, the public has a direct say in how energy-related policies are created and how the energy market functions. This study provides an evaluation of public perceptions of carbon emissions in developing countries. Previous studies have proved that public awareness play a significant role to build an attitude towards less use of energy and carbon emission (Coggin, 2023; Wu et al., 2022).

A study was conducted recently in China concluded that from an interdisciplinary standpoint, this systematic review contributes to the continuing scientific discussion on the connection between public awareness and low-carbon behavior, using the public's role in China's transformation into a low-carbon city as a case study. Based on the identified literature, we reviewed the low-carbon behaviors that will help low-carbon cities change, which will in turn help the general people understand low-carbon life and engage in low-carbon activities. We also highlighted the elements influencing the public's perception of a shift in their customary behavior (Galimova et al., 2022; Wu et al., 2022).

3. Theoretical Framework and Data

The quantitative mechanics of donations as a driver of carbon emission have been the primary focus of the study, which has also taken into account the impact of additional control variables such as GDP (Gardner et al., 1981) and foster economic growth in emerging digital economies. Recognizing that a large body of research has shown that repatriation is one of the most important factors that positively affect national output. The influx of foreign remittance also helps the economy manage its current account and reduces the dearth of foreign reserves. Using a two-gap model, remittance inflows have a direct effect on per capita income. However, to determine the degree of greenhouse gas emissions in economies that receive foreign remittance. The literature has demonstrated that foreign remittance influences changes in domestic capital investment and capital production through the GDP channel. When financial resources enter the economy and raise household living standards, this is an example of a micro influence on the economy. It suggests that the recipient's household spending power is increased as a result of the cash's entry into the economy, leading to an increase in the purchase of micro-level energy-efficient production inputs and home appliances. There is now a greater demand for energy sources. Carbon emissions rise more frequently than those from non- energy sources. This contextualization exerts microscale influence on the alleged inverse correlation between remittance inflows and carbon emissions.

The ensuing environment assessment function demonstrates that the level of public Awareness (EDU) serves as a substitute for research to investigate energy-efficient production factors resulting from globalization (EX), foreign remittance (REM), GDP, and power consumption (REC), among other factors. The following are examples of correlated and interdependent relationships between variables: 1) In order to make it simpler to comprehend the findings of this study, each variable has been transformed into logit form. Point elasticities and efficient coefficients can be found using the natural log form, which is an additional benefit. The following is an estimate of the log-linear model:

(2) In this instance, I am the nation (1, 2, 3, 4,..., N), and t is the time period and the standard errors.

3.1. Data

Albania, Belgium, China, Cairo, France, Italy, Guatemala, Italy, Indonesia, Italy, Israel, South Korea, Malaysia, Maghreb, Nepal, Nigeria, Pakistani, Poles, Russia, Philippines, Asia, Thailand, Ukraine, United States (USA), and Vietnam are among the top 25 recipients of foreign remittance. However, due to the lack of the data research variables, Lebanon, Russia, & Poland were not included in this study. From 1986 through 2020, an annual time frame was used for this investigation. The empirical analysis measures CO_2 emissions in tones, energy usage in billions of kilowatt-hours, secondary enrolment gross, public Awareness, and personal remittance receiving. GDP and export revenues are calculated using constant dollars US dollars. Data on CO_2 emissions, GDP, household remittance receipts, & public Awareness are available in Wadi Indicators (World Bank, 2019). Data on the consumption of energy and Trade Openness are provided by the Department of Energy (EIA, 2019) & World Bank (IMF, 2019), respectively.

3.2. Methodological Framework

To determine if indeed the null hypothesis could be ruled out in our representative panel data, this study used CD and LM inter dependence tests. These dependence tests validate the unobserved dependencies reported by Liddle and Lung (2014), who also claimed that cross-sections are intrinsically dependent on one another. Additionally, cross-sectional dependencies must be known in order to integrate new variables into the model and use consistent estimators that are unbiased.

The literature must direct us to the creation of the following model in order to capture the effect of financial inflows, such as FDI and remittance influxes, on the emissions of carbon dioxide in China:

$$CO_{2,t} = \omega_0 + \varphi_1 FDI_t + \varphi_2 \text{Foreign remittance}_t + \varphi_3 GDP_t + \varphi_4 FD_t + \varepsilon_t \quad (1)$$

We also include direct foreign investment (FDI), capital inflows (Remittance), and domestic product (GDP) as predictor factors in the carbon pollution (CO_2) function of China in Equation (1), which is a long-run model. We want to present the aforementioned model (1) in the error-correction format outlined by Pesaran and Yang (2020) in order to obtain the short-run estimates:

$$\Delta CO_{2,t} = \omega_0 + \sum_{k=1}^{n} GDP\ \beta_{1k} \Delta CO_{2,t-k} + \sum_{k=0}^{n} FDI\ \beta_{2k} \Delta FDI_{t-k} +$$

$$\sum_{k=0}^{n} GMM\ \beta_{3k} \Delta \text{Foreign remittance}_{t-k} + \sum_{k=1}^{n} GDP\ \beta_{4k} \Delta GDP_{t-k} + \sum_{k=0}^{n} GMM\ \beta_{5k} \Delta FD_{t-k} + \quad (2)$$

$$\omega_1 CO_{2,t-1} + \omega_2 FDI_{t-1} + \omega_3 \text{Foreign remittance}_{t-1} + \omega_4 GDP_{t-1} + \omega_5 FD_{t-1} + \varepsilon_t$$

According to Pesaran et al., (2001) equation (2) is an ARDL model. This equation contains estimates for the short-run and long-run coefficients. Long-run results are provided by the coefficients 2-5 normalized on 1, whereas short-run results are represented by the coefficients linked to the sign. The practice of co-integration is crucial to the reliability of the long-run outcomes and created two co-integration tests: the F-test and the ECMt-1. The main benefit of this architecture is that it can be used without unit root testing.

As a result, the variables integral at various combinations, i.e., I (0) or I (1), and even blends of them, can be incorporated in the ARDL model because it can take into consideration the integrating features of the variables. This is one of the fundamental tenets of the ARDL technique.

We divide the variables of our attention into both positive and negative halves as indicated here below Eqs. (3a), (iii and iv), (4a), and (4b) using the partial sum approach suggested by Shin et al. (2014) in order to see the uneven influence of financial inflow on Emissions of CO_2 in China.

$$FDI^{+}_{t} = \sum_{n=1}^{t} GMM\ \Delta FDI^{+}_{t} = \sum_{n=1}^{t} GDP\ \max(FDI^{+}_{t}, 0) \quad (3)$$

$$FDI^{-}_{t} = \sum_{n=1}^{t} GMM\ \Delta FDI^{-}_{t} = \sum_{n=1}^{t} GDP\ \min(\Delta FDI^{-}_{t}, 0) \quad (4)$$

$$\text{Foreign remittance}^{+}_{t} = \sum_{n=1}^{t} GMM\ \Delta\text{Foreign remittance}^{+}_{t} = \sum_{n=1}^{t} GDP\ \max\ (\Delta\text{Foreign remittance}^{+}_{t}, 0) \quad (5)$$

$$\text{Foreign remittance}^{-}_{t} = \sum_{n=1}^{t} GMM\ \Delta\text{Foreign remittance}^{-}_{t} = \sum_{n=1}^{t} GDP\ \min\ (\Delta\text{Foreign remittance}^{-}_{t}, 0) \quad (6)$$

Eqs. (3a) and (3b) offer the positive disturbances with respect to financial inflow factors (4a). On the other hand, Eqs. (3b) and (4a) provide information on the negative shocks to the factors of financial inflows (4b). We obtain Eq. (5) by replacing the original variables with the partial sum variables. In this study, long-run co-integration tests were conducted after defensive team root tests were employed to investigate the order of variable integration. The use of second-generation methods has various benefits. First, these consider the fact that panel works may have cross-sectional dependencies. They also capture trends and interdependencies in both series data and panel data, as well as their existence. Thirdly, second-generation tests offer consistent estimators, in contrast to first-generation methods. We used CIPS and Offer numerous benefits tests to verify the integration order. The co-integration method developed by Wester Lund with Edgerton (2008) has been used to examine structural fractures after long-run links between variables have been examined. Last but not least, quantile regression analysis was used to confirm the estimated results.

4. Results and Discussion

This study examined the relationships between CO_2 emissions in industrialized and emerging nations and the use of energy, economic issues, globalization, and natural resources. The time pair dynamically multiple regression, time pair dynamic GMM, and system GMM predictions were used in this study. Table 1 and Table 2 provide more information on the empirical findings. The results for developed countries are provided in Figure 2 while those for underdeveloped countries are presented in Table 2. Lagged CO_2 emission values range from 48 to 90% among developed nations as 25 to 92percent in underdeveloped nations. countries. This demonstrates how previous years' CO_2 emissions affect current years' CO_2 emissions in affluent countries by 80 to 90% and current years' CO_2 emissions in underdeveloped countries by 25 to 92%, respectively. The Sargan Test results indicate improved performance in Instrumental variable and overall GMM models.

Table 1: Description of Research Variables.

	Fixed effect	GDP	System GMM
Dependent variable CO_2			
$CO_{2i,t-1}$	0.674*** (0.0299)	0.489*** (0.0398)	0.906*** (0.0197)
EDU	0.0266** (0.0101)	0.0076 (0.0166)	0.0104*** (0.0037)
EX	0.0104 (0.0110)	−0.0197 (0.0205)	0.0135* (0.00678)
REC	−0.0437*** (0.0136)	−0.0665*** (0.0227)	−0.0097*** (0.0035)
Economic growth	0.925** (0.428)	1.146*** (0.665)	0.198** (0.0945)
Foreign direct investment	−0.0395 (0.0315)	−0.0355 (0.0391)	−0.0427 (0.0289)
Trade openness	−0.0118*** (0.0028)	−0.0167*** (0.0034)	−0.0016* (0.0007)
Innovation	0.0006 (0.0001)	0.0007* (0.0006)	0.0085*** (0.0008)
Urbanization	0.109** (0.0515)	0.1046* (0.0625)	0.0255 (0.0468)
Financial development	−0.0025* (0.0019)	−0.0005 (0.0017)	−0.0068*** (0.00089)
Economic globalization index	0.0357*** (0.0087)	0.0246* (0.0125)	0.0064 (0.0065)
Social globalization index	−0.0366*** (0.0109)	−0.0564*** (0.0217)	0.0055 (0.0078)
Political globalization index	0.0106 (0.0107)	0.0228 (0.0145)	−0.0096* (0.0058)
Constant	−4.168 (3.668)		0.254 (0.745)
Observations	605	543	606
R-squared	0.698		
Year dummy	Yes	Yes	Yes

Note: *, **, *** stands for 1 %, 5% and 10 % significance level respectively.
Source: Author calculation

The time pair dynamically multiple regression, time pair dynamic GMM, and system GMM predictions were used in this study show Figure 2, results for developed countries are shown in Table 1 and Table 2. The findings show that fuel exports have a positive and significant impact on Carbon dioxide emission in developed nations using the time mate dynamic fixed effect & time pair instrumental Variables estimators, respectively. However, the GMM estimator indicates a slight but positive correlation between this and CO_2 emissions. According to the findings, petroleum exports to industrialized countries are to blame for 1% to 2 percentage of environmental damage. This is due to a lack of fuel supplies in wealthy nations. This leads to an increase in the imports of fossil

fuels, which results in a rise in CO_2 emissions, along with a modest natural resource available for sustainable power. The results of the period pair static estimation technique the time pair platform GMM estimators show a positive association between ore and mineral resource exports and CO_2 emissions, whereas the timing pair GMM estimated shows a negative relationship. In China, Brazil, and India, discovered a negligible correlation between mineral wealth and CO_2 emissions. This connection was found to lower CO_2 emissions in Russia as a result of natural resource rents. All models reveal a negative and significant correlation between energy use and CO_2 emissions. The outcomes also show a decrease in CO_2 emissions brought on by the use of energy. Because the usage of energy lowers CO_2 emissions, industrialized nations can utilize more energy to reduce their CO_2 emissions. Growing the use of energy sources may not only ensure but also reduce CO_2 emissions. The findings of this study are consistent with those of the following investigations: but instead. They demonstrate that when the use of energy increases, CO_2 emissions decline. CO_2 emissions and economic growth have a significant and positive connection. The findings show that CO_2 emissions rise as a result of economic expansion in industrialized nations and illustrate that a 1% rise in economic growth is associated with an increase in environmental damage. In industrialized nations, where achieving economic growth is prioritized over environmental protection, economic expansion is the primary contributor to CO_2 emissions.

Table 2: Descriptive Statistics of Study Variables.

	Fixed Effect	GDP	System GMM
Dependent variable CO_2			
$CO_{2i,t-1}$	0.676*** (0.0161)	0.254*** (0.0336)	0.926*** (0.0056)
EDU	−0.0034** (0.0015)	−0.0126*** (0.0024)	−0.0016*** (0.0008)
EX	−0.0016 (0.0023)	−0.0007 (0.0026)	−0.0006 (0.0006)
REC	−0.0074** (0.0027)	−0.0294*** (0.0057)	−0.0018*** (0.0006)
Economic growth	0.425*** (0.126)	1.734*** (0.217)	0.0988*** (0.0235)
Foreign direct investment	0.0407*** (0.0155)	0.0626*** (0.0177)	0.0295*** (0.0097)
Trade openness	0.0026** (0.0011)	0.0004 (0.0013)	0.0005*** (0.0005)
Innovation	0.0005*** (0.0007)	0.0008*** (0.0005)	0.0004*** (0.0004)
Urbanization	−0.0275* (0.0147)	−0.178*** (0.0326)	−0.0116*** (0.0074)
Financial development	−0.0011 (0.0015)	−0.0015*** (0.0018)	0.0018*** (0.0004)
Economic globalization index	−0.0078*** (0.0025)	−0.0128*** (0.0046)	−0.0014*** (0.0014)
Social globalization index	−0.0108*** (0.0054)	−0.0248*** (0.0064)	−0.0026*** (0.0013)
Political globalization index	0.0058*** (0.0025)	0.0105*** (0.0045)	0.0004***(0.0004)
Constant	−2.648*** (0.855)		−0.913*** (0.205)
Observations	1,378	1,168	1,378
R-squared	0.714		
Year dummy	Yes	Yes	Yes

Note: *, **, *** stands for 1 %, 5% and 10 % significance level respectively.
Source: Author calculation

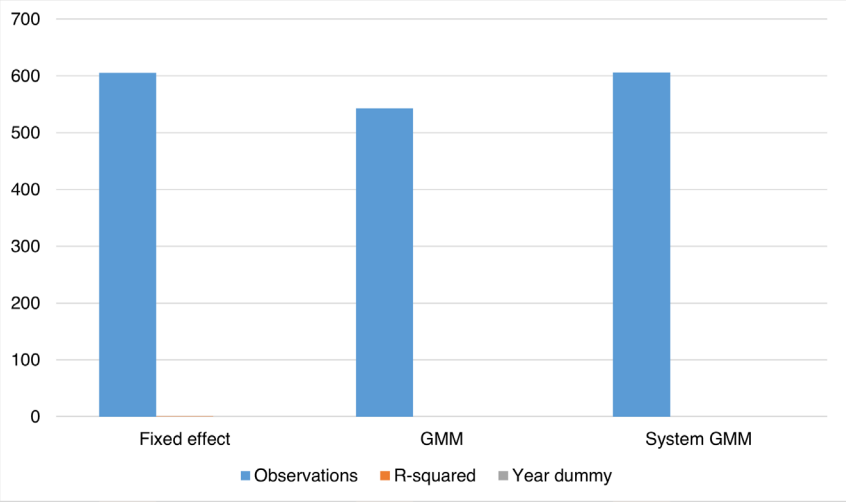

Figure 3: Time Pair Dynamic GMM, and System GMM Predictions Were Used.

The findings of this study on income progress in developed nations are consistent with those of earlier research that found a rise in CO_2 emissions is a result of economic growth. All models demonstrate a weakly negative relationship between FDI inflows and CO_2 emissions. The research relatively small amount, which demonstrates that foreign investment increase environmental pollutants, is not comparable to our findings. The findings also demonstrate that in all models, trade openness exhibits a significant and detrimental association with environmental contaminants. The findings show that trade openness causes a 1–2% decrease in environmental pollution. The majority of wealthy countries export their outmoded technology to developing nations, which increases

pollution in developing nations while lowering it in developed nations. In static GMM and system GMM estimators, the innovation shows a positive and substantial association with environmental contaminants, however dynamic fixed effect estimators only indicate a positive but minor connection. The outcomes of innovation demonstrate that environmental contaminants rise as a result of innovation. Our findings go counter to earlier research that indicates innovation reduces environmental pollution. According to this study, innovation has a direct and noticeable impact on the rise in environmental contaminants. Dynamic panel regression and GMM estimators demonstrate a positive, significant relationship between the urbanization indicator and environmental pollution, but the systemic GMM shows a positive but negligible relationship. According to the findings, urbanization is to blame for a 2–10% rise in environmental contaminants in developed countries. The studies claimed that urbanization causes an increase in CO_2 emissions and showed that urbanization is the primary driver of CO_2 emissions. Urbanization is the primary factor that raises China's environmental pollution. However, has a negative impact on environmental pollution in all nations, regardless of whether they have lower, middle-, or higher-income economies, and it makes it worse in top half and high-income economies.

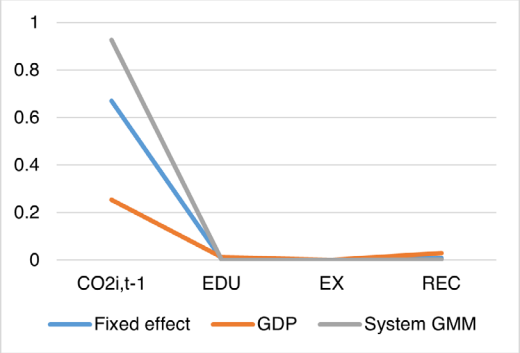

Figure 3: Environment and Financial Development Dynamic Linear Regression and System GMM, while the GDP Estimator.

The environment and financial development are linked, albeit not directly. Pollution in dynamic linear regression and system GMM, while the GDP estimator showed a weak but negative correlation with environmental pollution in Figure 3. The dynamic response variable and network GMM estimators both support the idea that financial progress leads to a decline in environmental pollution. The demonstration in earlier studies that growth accounting investment in clean energy helps to reduce environmental pollution. The economic, social, and political dimensions are used to calculate globalization. The dynamic response variable and GMM estimators of the economic globalization signal reveal a direct, significant correlation with CO_2 emissions, while the system GMM estimator shows a positive but negligible association with environmental pollution. While social globalization has a positive and minor association with Carbon dioxide emission in the digital - age estimator, it does exhibit an indirect and substantial connection to environmental damage in the dynamics fixed effect & GMM estimators. Political globalization, however, displays a negative, significant link with CO_2 emissions within system GMM estimators but a positive, negligible relationship w Emissions of CO_2 there in dynamic fixed effect estimators. Globalization raises CO_2 emissions through supplying out-of-date machinery, FDI, and trade with other nations. However, when cutting-edge, energy-efficient machinery is used in manufacturing processes, globalization can minimize CO_2 emissions. These have a significant potential to reduce emissions. The findings of this study's social globalization study run counter to earlier findings that claimed that environmental pollution is increased by globalization factors like social globalization, political globalization, and economic globalization. The results for emerging nations are shown in Table 2. According to the findings, gasoline exports have a negative and considerable impact on CO_2 emissions. According to research, petroleum exports from emerging nations reduce environmental pollution. Results from all models show a positive, albeit negligible link between ore and metallic exports and CO_2 emissions. A third or more of the developing nations sell their ample fuel supplies to other nations. Exporting large quantities of local fuel resources reduces CO_2 emissions, therefore countries that want to reduce their emissions will benefit if exports rise. Natural resource rents were determined to have a negligible impact on CO_2 emissions in Pakistan, Argentina. However, a decrease in CO_2 emissions in Russia was brought about by Both Table 1 and Table 2 demonstrate a negative and significant correlation between the consumption of energy and CO_2 emissions. The findings further suggest that the primary driver of the decline in CO_2 emissions is the rising usage of energy. In addition to providing the energy for industrialization, the usage of energy sources may also help to lower CO_2 emissions. The findings concur with those of research by Number of different, which showed that the usage of energy reduces CO_2 emissions. Environmental pollution rises when economic growth rises in developing countries, and economic expansion has positive and strong relationships with CO_2 emissions. These nations' societies place less value on environmental preservation as their economies grow. The results of this study, which show that economic expansion raises the levels of environmental pollutants, are consistent with those of earlier research. In all models, FDI inflows have positive and notable relationships with environmental damage. The findings are connected to earlier research that showed FDI inflows increase environmental pollution. The dynamic response variable and instrumental Variables estimation methods of trade openness likewise indicate a strong and significant association with environmental damage, however the GMM estimator only demonstrates a positive but negligible association with CO_2 emissions. According to the estimated results, trade openness causes a rise in environmental pollution. These the findings are in line with those of investigations which found that globalization increases environmental contaminants. The innovative results support a strong and positive correlation between all models and environmental pollution. The outcomes of innovation demonstrate that environmental pollution rises as a result of innovation. These findings are in direct opposition to those of earlier research, which found that innovation reduces environmental pollution. According to this study, innovation has directly and significantly increased environmental degradation. In the dynamic fixed and random effect and GMM estimators, the urbanization results show negative, significant associations with environmental pollution, whereas the system GMM shows a negative, negligible link with CO_2 emissions. The results show that urbanization is reducing environmental pollution in developing nations. The findings of this study are at odds with those of a prior study which claimed urbanization was the primary cause of environmental degradation and that pollution levels increased as a result. According to, urbanization is the primary cause of China's rising environmental pollution. In addition, magnifying environmental pollution in topmost and high-income economies,

where it has a negative influence on urbanization levels in lower, middle-, and high-income economies. China's capital and consumption had very different carbon footprints. The typical consumption-based estimates of Gas emissions of capital spending, known as EFGFCF, was estimated to be 69 Gt from 1995 to 2015. The securities that had previously been used up (FK) all throughout same time period only held 24 Gigatons of GHG emissions. This suggests that the production and utilization of future financial output accounts for more than 65% of both the GHGs previously produced during the development of capital. In potential consumer / governmental assessments of sustainable, productivity, and equity of resource use, including carbon diets or carbon taxes, it is important to consider whether taking into account this percentage of historically emitted emissions might have a significant influence. Although the estimation of in recent years is conservative (where it will be further mentioned inside the following section), it can still provide enough information about the effects of dynamic capital here on current Greenhouse - gas footprint assessment. As previously mentioned, usage of capital investments invested even before 1995 is really not taken into consideration in our analysis. Financial reporting (FK) and wealth creation consumer products are substantially different from one another (Figure 2). Housing, construction, and manufacturing of capital goods accounted for the majority of the cumulative GHGs linked with capital investment. Examples of these are "Other non-metallic mineral commodities," "Construction work," and "Others," such as metal and non-metallic mineral ores (e.g., "Chemicals and chemical products," and "Others," like machinery). The majority of the greenhouse gases contained in capital consumption were produced by the provision of services including "Brokers," "Public administration assistance," and "Public Awareness facilities." When considering production, we may conceive of capital investment and capital consumption. to better understand these discrepancies from the consumer's point of view. The electricity created by the nuclear reactor is distributed to the service sectors for use in their manufacturing, and the sill that use this electricity as capital consumption are responsible for the related GHG emissions. As an illustration, the power generation industry makes investments in power plants, and the GHG emissions that result from such investments are recorded as GHG emissions embedded in capital investment. Since capital consumption made up nearly the entire first layer of the financial loop and accounted for 98% of all GHG emissions, it appeared that the consequences of the material loop did not significantly contribute to those emissions.

4.2. A Suggestions for Future Action

By examining the effects of sustainable technology on CO_2 emissions in the face of significant control characteristics that have been ignored in previous studies, this work adds to the body of recent research. The study investigates the connection between green growth and carbon dioxide emissions in G7 nations by examining GDP, taxation, social capital, RECs, and environmentalists. The results of the econometric estimation are reliable: There is compelling evidence that there is a long-term correlation between CO_2 emissions and a variety of variables, such as eco-innovation, human capital, energy certificates (RECs), ecological sustainability, company tax, and the gross national product. Also, the two models battle with incline heterogeneity, all are fixed at the underlying contrast, and all boundaries are cross-sectionally subordinate. v). The GDP, GDP2, EI, HC, and REC hall of the G7 countries have a significant impact on CO_2 emissions. vi) Apart from GDP, all other criteria negatively affect carbon dioxide emissions; vii) The significant and negative coefficients of the ECM back up previous studies regarding the consistency of variables' interactions; viii) The concave friendship between GRE is shown by the probabilities of GDP to Industrial output Square's from 1 to 0 signs. This report makes insightful recommendations to environmentalists and decision-makers regarding the policies that are proposed. After that, App nations. Green growth, eco-innovative policies, and environment pricing through taxation must be prioritized by Table 8 (G7) nations in order to address the deteriorating environment. Industry's reliance on non-renewable resources could be replaced by renewable ones by environmentalists and plants, reducing CO_2 emissions. Green growth is also thought to be an important way to achieve sustainable development. To achieve the United Nations' Development Goals (MDGs), countries in Table 8 (G7) must focus on a green growth strategy. Sustainable development of the environment and the reduction of poverty can both be accomplished through the concept of "green growth." Emanations in view of interest are expected to by and by, and they can be achieved with the guide of eco-accommodating advances, store network enhancements, and more maintainable creation strategies. Furthermore, raising CO_2 emissions may be discouraged by environmental taxes. Investors create environmentally friendly businesses to avoid these costs. Additionally, environmental taxes encourage ecological and economic efficiency, both of which contribute to the reduction of CO_2 emissions. It is anticipated that environmental taxes will alter investment and consumption patterns by encouraging efficient and environmentally friendly industrial practices. In addition, the development of human capital is necessary for these programmers' successful implementation. People will be more aware of the use of environmentally friendly technologies if we improve and invest in human capital. In the GMM estimator, the bank profitability indicator has a significant positive correlation with environmental damage, while in the dynamic linear regression and system GMM, the correlation is only slight and indirect. based on previous research and generally. Environmental pollution is reduced as a result of growth accounting investments in the production of energy. The system GMM's results for the globalization indicator show a negative and insignificant relationship with environmental degradation, while the dynamically linear regression and GMM estimators show a direct and significant relationship. Social globalization, on the other hand, has an indirect but significant connection to environmental damage in all models, while political globalization has a positive, strong relationship with carbon dioxide emission in the lively fixed effect and Instrumental variables estimators and a positive, minor association with carbon dioxide emission in the system GMM. Since emerging nations import cutting-edge, energy-efficient machinery for use in their manufacturing processes, which reduces CO_2 emissions, socioeconomic globalization is essential for reducing CO_2 emissions. Previous studies claimed that globalization factors like social globalization, political globalization, and economic globalization increase environmental pollution. However, the findings of both social globalization and economic globalization contradict these claims. Cross-sectional dependent (CSD) is a common issue in panel data that must be evaluated in order to obtain accurate and efficient estimated parameters. Therefore, in the early stages of econometric analysis, those who are interested in resolving this issue investigate the existence of CSD. This study uses the five CSD tests to get accurate results. Table 1 displays the results of the Wd test. For the LNEX, the

Pesaran CSD test rejects the null hypothesis at a level of 10% significance, whereas the Pesaran test rejects the null hypothesis at a level of 1% significance. the remaining three examinations. The fact that all variables have cross-sectional dependence suggests that the environmental plans of the nation's being studied are interdependent. In contrast, whenever one of the 22 nations experiences a random shock, the rest of the nations are also affected. Therefore, environmental policies that improve environmental quality can be developed for the analyzed nations. These discoveries propose that CDI for boundaries ought to be viewed as in the concentrate's later stages.

Table 3: Regression Results of the STIRPAT Model.

	OLS	FE	RE
Ln_GDP	1.005***	0.995***	1.005***
	[0.027]	[0.078]	[0.027]
Ln_FDI	1.0156**	0.175***	0.895***
	[0.027]	[0.054]	[0.028]
Ln_GMM	1.015***	0.898***	0.957***
	[0.027]	[0.015]	[0.025]
Ln_CSD	−0.057	0.018	0.028
	[0.055]	[0.026]	[0.025]
Ln_CDI	0.27***	−0.186***	−0.138**
	[0.075]	[0.058]	[0.0576]
Ln_CIPS	−0.017	−0.006	−0.005
	[0.015]	[0.008]	[0.008]
Ln_ CADF	−0.227***	0.076***	−0.095***
	[0.036]	[0.027]	[0.027]
GHG	−20.217***	−11.708***	−17.196***
	[0.658]	[0.468]	[0.428]
F test		Prob > chi2 = 0.005	
Hausman		Prob > chi2 = 0.007	
N	237	235	238
R^2	0.996	0.978	0.986

Note: *, **, *** stands for 1 %, 5% and 10 % significance level respectively.
Source: Author calculation

Second-generation panel methods like CIPS and CADF can be applied at this point after looking into whether CSD exists. Table 2 summarizes the findings of the CIPS and CADF tests. It is clear that at the level intercept level, foreign remittance, GDP, usage of energy sources, and carbon emissions all have unit root issues. Additionally, we observe that when the initial variations in the variables are taken into account, the problem is solved. As a result, at the initial differences, all variables are stationary. Even if these variables have a unit root problem, combining them over time can lead to a significant cointegration relationship. This study has utilized Provides the flexibility and Edgerton's (2008) approach to investigate the long-term link among the modelled variables they're being a CSD, and approach developed. Two applications for econometric estimations. This strategy makes it possible to explore the slopes of heterogeneity and sequentially linked errors in adding to being a useful method for determining whether CSD exists. This method is also suitable for investigating whether panel data contains structural breakdowns. Because it takes into account CSD, potential structural breaks, and heterogeneity, the Wester Lund and Eastman (2008) test is used in this investigation. The results of co-integration are displayed in Table 5.

Table 4: Threshold Regression Results.

(1)	(2)	(3)	(4)	(5)	(6)	
Ln_GDP	0.985***	0.962***	0.976***	1.024***	1.027***	0.993***
	[0.009]	[0.016]	[0.017]	[0.017]	[0.024]	[0.026]
Ln_FDI	0.887***	0.873***	0.874***	0.904***	0.908***	0.894***
	[0.015]	[0.014]	[0.018]	[0.017]	[0.024]	[0.026]
Ln_GMM	0.884***	0.887***	0.874***	0.904***	0.908***	0.894***
	[0.017]	[0.015]	[0.019]	[0.017]	[0.014]	[0.017]
Ln_CSD		0.185***	0.184***	0.214***	0.208***	0.174***
		[0.068]	[0.059]	[0.057]	[0.055]	[0.057]
Ln_CDI			−0.024	0.015	0.018	0.015
			[0.024]	[0.027]	[0.024]	[0.027]
Ln_CIPS				−0.175***	−0.177***	−0.185***
				[0.057]	[0.059]	[0.058]
Ln_CADF					0.004	−0.005
					[0.008]	[0.007]
GDP^2						0.074***
						[0.027]
GHG	−11.346***	−12.257***	−12.327***	−12.514***	−12.484***	−11.705***
	[0.176]	[0.317]	[0.335]	[0.327]	[0.367]	[0.447]
N	235	235	237	235	238	235
R^2	0.985	0.987	0.983	0.982	0.946	0.997

Note: *, **, *** stands for 1 %, 5% and 10 % significance level respectively.
Source: Author calculation

Three alternative models—the no shift, norm shift, and regime shift—are used in this approach proposed by 's information and Edgerton (2008) to examine the cointegration connection between variables. The null hypothesis, which states that there is no Johansen co-integration relationship between variables for any model, is disproved by Table 3. These findings show that economic growth, export variety, energy, emigration, and CO_2 emissions are all related over the long term. Theoretically, conceptual breaks can happen when there is an uncertain economic supply shock, whether it is internal or external, when there is a change in technology or asymmetric information that affect economic activity and the business cycle, when there is a structural adjustment in the Labouré to capital ratio, and when there are territorial changes. But these structural shocks have an effect on the economy in the long term by permanently altering the socioeconomic drivers of the economy. Knowing that shock can be received if the economy is on a convergence track, however, defines the degree of institutional reforms that would be abrupt or gradual towards convergence or dispersion path depending on how vulnerable the economic system is. The break periods for each nation are determined endogenously and individually in this context by Wester Lund and Edgerton (2008). In Table 4, the test calculations for structural breaks from Wester Lund and Edgerton's (2008) methodology are shown which confirm the existence of cointegration. The Asian nations included in the analysis confirm the consequences of the decrease in GDP after World War II, providing insight into the causes of these structural mean and regime upheavals. But according to data cited by the Băhnăreanu (2019), nearly all Asian nations have seen long-term changes in their economic structures as a result of the bilateral trade of Asian lions in the area, which has reduced trade gains for small and fragile economies. It is clear that there is a considerable difference between transitional-structural means and regime shifts in Egypt, Italy, Morocco, and Pakistan. However, structural change has occurred after 2007–2008 in Belgium, France, Italy, Pakistan, the US, and Ukraine. It suggests that after being exposed to the financial meltdown, which had a considerable impact on the manufacturing level of trading digital economies, these economies have undergone structural consequences in the long-term economic path. Large-scale businesses cease operations due to low global demand, and countries face huge external current account balances for almost half a decade.

Table 5: Heterogeneity of Population Size.

Low	Medium	High	
Ln_GDP	0.996***	1.047***	0.767***
	[0.027]	[0.024]	[0.038]
Ln_FDI	0.815***	0.034***	−0.176***
	[0.107]	[0.086]	[0.058]
Ln_GMM	1.005***	0.928***	0.865***
	[0.017]	[0.025]	[0.028]
Ln_CSD	−0.014***	−0.027***	0.155***
	[0.015]	[0.014]	[0.037]
Ln_CDI	0.058***	−0.075***	−0.005***
	[0.084]	[0.085]	[0.055]
Ln_CIPS	0.007***	−0.019**	−0.007***
	[0.005]	[0.005]	[0.004]
Ln_CADF	−0.044***	0.008***	0.227***
	[0.024]	[0.016]	[0.034]
GHG	−17.636***	−12.057***	−6.718***
	[0.584]	[0.535]	[0.496]
N	78	78	89
R^2	0.994	0.997	0.996

Note: *, **, *** stands for 1 %, 5% and 10 % significance level respectively.
Source: Author calculation

In the current study used the Least Sq (Cup-FM) and Constantly Updated Bias-Corrected (Cup-BC) techniques to investigate the extent of long-term association between variables after establishing the co-integration link between the variables. These methods efficiently investigate the long-run equilibrium level regardless of the sample size, the order in which the variables are integrated, or the endogeneity of the equation. Additionally, Cup-FM & Cup-BC long-run data are included in Table 6.

Table 6: Heterogeneity of Energy Consumption Intensity.

Low	Medium	High	
Ln_GDP	0.956***	1.146***	1.005***
	[0.038]	[0.025]	[0.018]
Ln_FDI	−0.015***	0.408***	0.056***
	[0.066]	[0.095]	[0.035]
Ln_GMM	0.746***	0.848***	0.969***
	[0.047]	[0.026]	[0.025]
Ln_CSD	0.045***	−0.014***	0.018***
	[0.026]	[0.019]	[0.027]
Ln_CDI	−0.205***	−0.509***	0.076***
	[0.048]	[0.076]	[0.056]
Ln_CIPS	0.006***	0.008***	−0.015***
	[0.005]	[0.005]	[0.005]
Ln_CADF	0.085**	−0.026***	−0.015***
	[0.030]	[0.027]	[0.028]
GHG	−9.015***	−13.139***	−12.904***
	[0.545]	[0.616]	[0.357]
N	77	78	74
R2	0.998	0.996	0.996

Note: *, **, *** stands for 1 %, 5% and 10 % significance level respectively.
Source: Author calculation

The econometric study yields some intriguing results when the results in Table 6 is examined. First, in some remittance receiving economies, a lower level of environmental quality was linked to the existing degree of education and awareness of research. According to the Cup-FM и Cup-BC estimation method, CO_2 emissions rise by 0.006-0.068% as EDU rises by 1%. Environmental quality is anticipated to be positively impacted by both public Awarenessal attainment and research & development efforts. However, when the panel's nations are looked at, it becomes clear that there is still much work to be done, particularly for Asian nations to improve the standard of public Awareness and raise environmental consciousness. Pasquale Avella et al. (2017) in Australia support this finding for the economies of Latin America and the Caribbean. The assessed nations have not yet attained the degree of public Awareness required to make the switch from fossil fuels to energy sources. Additionally, there is a negative correlation between Trade Openness and environmental deterioration. A 1% increase in EX in this situation reduces CO_2 emissions by 0.256-0.236%. The findings of Mania (2020) for advanced economies, for Korea, China, and Korea are all in agreement with this outcome. Additionally, the World Bank and International World Bank and international monetary (IMF) advise Trade Openness strategies for nations with undiversified product markets and developing economies in order to achieve sustainable growth. Thus, the 22 nations in our sample that receive foreign remittance can enhance environmental quality by expanding Trade Openness. Fourth, deterioration of environmental quality is a result of economic growth. A 1% rise in GDP results in a 0.617–0.676% increase in CO_2 emissions. The findings show that's rising productivity and

GDP have made it more difficult to implement carbon emission control policies, as GDP has a large and favorable influence on CO_2 emission in current R&D, remittance inflow, and the development of energy resources. This result is consistent with findings made by Ni et al. (2020) for various income countries. The EU, and because for ten countries, all of which claimed stated economic growth has yet to reach the level necessary to stop environmental damage. Finally, the environmental quality of 22 countries that receive foreign remittance is being improved by energy technologies. According to a small but important piece of evidence in our paper, a 1% increase in REC reduces CO_2 emissions by 0.110-0.096%. This result ensures support for a number of earlier publications, including Khattak for EU, which examined the top 10 polluting countries. It also runs counter to several research. In addition, for some panel data, a change in productivity structure brought about by including energy inputs into the production plan considerably decreased carbon emissions over time.

The journal's editor and three thank the reviewers received a lot of valuable feedback, which the authors appreciate. Any inaccuracies that remain are our own.

Table 8: Non-parametric Localized Kernel-based Regression Statistics.

Country	Variable	Model: ln_Energy_Cons =f(ln_GDP_Per_Capita+ln_Trade)				
		Effect Estimates	Effect Std. Err	Effect p-value	Effect Bandwidth	R-squared
China	GDP per capita	0.2564***	0.0595**	0.0005**	0.5224**	0.9913
	Trade	0.2034***	0.1096**	0.0627**	5.9127**	
USA	GDP per capita	−0.1287***	0.0925**	0.1674**	0.13164**	0.8726
	Trade	0.1005***	0.0983**	0.3097**	0.3857**	
India	GDP per capita	0.2687***	0.0691**	0.0008**	0.4545**	0.9874
	Trade	0.0885***	0.0702**	0.2049**	0.1816**	
Russia	GDP per capita	0.1194***	0.0413**	0.0040**	0.5174**	0.9216
	Trade	0.1116***	0.2053**	0.5887**	0.1687**	
Japan	GDP per capita	0.1484***	0.0474**	0.00254**	0.5825**	0.9594
	Trade	0.0096***	0.0767**	0.8976**	0.1447**	
Canada	GDP per capita	0.1454***	0.0516**	0.0054**	0.2056**	0.9913
	Trade	0.1586***	0.1074**	0.1423**	0.3008**	
Germany	GDP per capita	−0.0346***	0.0367**	0.3082**	0.32056**	0.8212
	Trade	−0.0286**	0.06554**	0.6615***	0.58375**	
Brazil	GDP per capita	0.1665**	0.0129**	0.00037***	0.54635***	0.9635
	Trade	0.1317**	0.0498**	0.0085***	0.1797***	
South Korea	GDP per capita	0.4395**	0.0827***	0.0007***	0.32814***	0.9957
	Trade	0.3164**	0.2695***	0.2395***	0.2525***	
Iran	GDP per capita	0.3036**	0.1467***	0.0397***	0.4297***	0.7869
	Trade	0.1187	0.4405**	0.78904***	0.2605***	

Note: *, **, *** stands for 1 %, 5% and 10 % significance level respectively.
Source: Author calculation

Table 8 presents the generalized quantile regression findings based on Equation 1. These results show that the EU significantly and favourably affects environmental pollution in all quantiles. The impact on emissions is greatest there in middle data points (Q 0.4, Q 0.5, and Q 0.6). EX significantly and negatively affects emissions in every quantile but the first. The last quantile is where this effect reaches its maximum severity (Q 0.9). This demonstrates the need for greater Trade Openness in countries with higher emissions. We know that EX improves environmental quality because of long-term estimations and the results of quantile regression. Foreign remittance's effects on in every quantile, CO_2 emissions are negative and significant. As we approach the medium quantiles, the effect of Sleep, which is rather minor during the first quantile, grows on the emission. Investigating GDP's effect on emissions reveals that it has a substantial and diminishing effect from low data points to high quantiles. Further it can be described as, job expansion in nations with higher emissions puts strain on the environment. On the other side, environmental quality is less affected by economic expansion in nations with smaller emissions. Finally, REC has a considerable negative impact on CO_2 emissions across all quantiles. At the Q 0.1 decile, REC has the least impact, but the Q 0.5 quantile has the most influence. In this regard, REC contributes more to environmental quality development in nations with intermediate levels of emissions.

5. Conclusion

This study looked at the connections between using energy, diversifying exports, training, foreign remittance, and CO_2 emissions in 22 of the top economies that receive foreign remittance. The study started the econometric analysis by looking for a Disc in the data in order to accomplish this. After locating the CD in the series, we carried out the CIPS and CADF backcourt root tests, and we discovered that each parameter was first-order stationary. We then applied the Provides a better way and Edgerton (2008) method, based on the idea that the 22 countries under study could have different series breakpoints. When energy and economic growth are included in the model, public Awareness and CO_2 emissions are integrated, as demonstrated by the outcomes. The generalized quantile regression approach, CUP-FM, and CUP-BC procedures are utilized to investigate the connection between the variables following cointegration. The strategies' all's discoveries upheld the thought that send out expansion and settlements decrease fossil fuel byproducts in our board. In a similar vein, using energy results in lower CO_2 emissions. However, pollution rises, and environmental conditions worsen as a result of economic growth and public Awareness expansion emerging digital economies. The findings of the study point to potentially significant policy implications. The countries under study would also benefit from loosening regulations on labor, credit, and other markets to increase Trade Openness. Countries with higher emission levels will benefit

most disproportionately from stable revenue from Trade Openness. Thirdly, despite being unexpected, the results demonstrate that public Awareness has a negative effect on improving environmental quality, which is consistent with earlier research and Balaguer's and Cant Avella's findings. These results show that without a curriculum that is environmentally friendly, public Awareness alone cannot cut CO_2 emissions. A comprehensive set of climate regulations are necessary for public Awareness to be beneficial; Otherwise, people's purchasing power will rise, they will use more energy, and eventually the environment will get worse. Include environmental content, increase media awareness, and educate the workforce about energy efficiency are all appropriate policy choices to enhance the environmental benefits of public Awareness. Fourthly, the use of energy technologies reduces emissions, as demonstrated by our research. energy sources reduce emissions in every circumstance, regardless of a nation's emission status. However, energy requires a significant amount of infrastructure. However, these technologies gradually save money once they are installed. Countries whose economic structures have been impacted by this circumstance face challenges. These nations must stabilize their energy supply, beginning with power sources like solar and biomass that are less expensive. So, it should be used wisely to get the most out of the limited financial resources that are available for long-term growth. Lastly, economic expansion has increased environmental pollution, indicating that the top 22 remittance recipients have not yet experienced green growth. For long-term prosperity, switching to clean economies is now necessary. Governments shouldn't be afraid to use some of these tools: I to boost foreign remittance and either reduce or eliminate tax breaks. ii) They ought to support and encourage the development of online applications by the financial sector. iii) To increase environmental consciousness, both the private and public sectors, particularly public Awareness establishments, ought to receive environmental consciousness public Awareness. iv) Export-related industries should receive subsidies that increase the variety of exports, and the establishment of a dedicated team of specialists in this field ought to be of assistance to exporters. Fifth, SDGs presently assume a critical part in settling financial and natural issues on a worldwide scale. This report provides crucial information regarding SDGs 7 and 13. Our investigation reveals that utilizing energy reduces carbon emissions. The findings of this study therefore provide support for the SDG 7 goal, which encourages the use of cleanse energy and the development of sustainable energy technology. This study also uses carbon emissions as a model to look at GDP, which is important for dealing with climate change. Equation 1 is essential for displaying early climate change detection signs. By using energy, broadening their export markets, and receiving foreign remittance, the nations examined were able to boost their GDP, as this study demonstrated. This study has some limitations and opens the door for future research: I Panel data were used to investigate how foreign remittance affects the quality of the environment.

5.1. Policy Implications

The individual achievements of nations may be the focus of subsequent research. CO_2 emissions are the most commonly used indicator of environmental pollution. Various pollutant indicators can be used by researchers to compare results from all of this research. Future research that employs a variety of iterations of the Environmental Kuznets curve may provide a fresh perspective on how foreign remittance affect environmental quality. Include environmental content, increase media awareness, and educate the labor force about energy effectiveness are all appropriate policy choices to enhance the environmental advantages of public Awareness. Fourthly, the use of energy technologies reduces emissions, as demonstrated by our research. Energy sources reduce emissions in every circumstance, regardless of a nation's emission status. However, energy requires a significant amount of infrastructure. However, these technologies gradually save money once they are installed. Countries whose economic structures have been impacted by this circumstance face challenges. These nations must stabilize their energy supply, beginning with power sources like solar and biomass that are less expensive. So, it should be used wisely to get the most out of the limited financial resources that are available for long-term growth. Lastly, economic expansion has increased environmental pollution, indicating that the top 22 remittance recipients have not yet experienced green growth. For long-term prosperity, switching to clean economies is now necessary. Governments shouldn't be afraid to use some of these tools: to reduce or eliminate tax breaks, increase foreign remittance, or both. ii) They ought to support and encourage the development of online applications by the financial sector. iii) To increase environmental consciousness, both the private and public sectors, particularly public awareness establishments, ought to receive environmental consciousness public Awareness. iv) Export-related industries should receive subsidies that increase the variety of exports, and the establishment of a dedicated team of specialists in this field ought to be of assistance to exporters. Fifth, SDGs presently assume a critical part in settling financial and natural issues on a worldwide scale. The information in this report is crucial. Our investigation reveals that utilizing energy reduces carbon emissions.

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About Authors

Dr. Muhammad Naeem Shahid

He is affiliated with The Business Administration, Cholistan IBA, Cholistan University of Veterinary and Animal Sciences, Bahawalpur, Punjab, Pakistan.
Email: naeemshahid@cuvas.edu.pk

Erum Fatima

She is Affiliated with The Department of Management Sciences, DHA Suffa University, Karachi, Sindh, Pakistan.
Email: efatima@dsu.edu.pk

Hassam Gul

He is Affiliated with The Department of Management Sciences, DHA Suffa University Karachi, Pakistan.
Email: hassamgul20@gmail.com.

Mohsin Ali

He is Affiliated with The School of Economics Finance & Banking, Universiti Utara Malaysia, Kedah, Malaysia
Email: mohsinpak@yahoo.com