https://doi.org/10.52131/jee.2020.0101.0002

*i*RASD Journal of Energy & Environment

Volume 1, Number 1, 2020, Pages 14 - 25

Journal Homepage:
https://journals.internationalrasd.org/index.php/jee

Examined EKC Hypothesis in the Presence of Renewable & Nonrenewable Energy and Trade & Financial Developments for Pakistan

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ARTICLE INFO

Article History:
Received: April 22, 2020
Revised: June 12, 2020
Accepted: June 28, 2020
Available Online: June 30, 2020

Keywords:
Renewable energy,
Nonrenewable energy,
Trade directness,
CO2 emissions,
ARDL

ABSTRACT

Most of the existing literature uses energy consumption to verify the effect of energy use on environmental degradation, but they fail to explore it. To achieve the revealed gap, the present study insists on the impact of the nonrenewable and renewable energy consumptions, financial development, trade liberalization & income on carbon dioxide (CO2) by using the environmental Kuznets curve theory. This study used Pakistan's time series data for the time period of 1990 to 2018. This study used two famous unit root tests which are the Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) test. Results confirm that RENERG has stationary at the level and NRENERG, CO2, GDP, GDP2, FINDEV, and TRD become stationary at first difference. Furthermore, ARDL bound test is used to analyze the model, the bound test indicates that there exists co-integration in the model and ARDL estimates the short and long-run estimates of the equation. The rise in renewable energy consumptions, economic developments, and trade openness reduces emanation of the carbon whereas the increase in renewable-energy consumption hints at carbon releases it also validates the EKC hypothesis in Pakistan. The study concludes that Pakistan's government and regulatory authorities should initiate the programs by which they are aware of the public and citizens about the adoption of renewable energies and environmental protection levels.

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1. Introduction

In 2015, 196 economics signed the climate change (UNFCC) agreement to protect the environment. Since 1995 economies made annual meetings to define the actions to control the problem of conservatory gas emissions (CHGs) and global warming. There is a significant and prominent effect of the UNFCC agreement which is to reduce the conservatory gasses emissions in industrialized countries in the presence of the Kyoto protocol that was the obligation for most of the countries. However, the Kyoto protocol certainly did not develop as an actual global contract. The first and second amendments of the Kyoto protocol comprised only of the European Union.

At the same time, with UNFCCC, Kyoto Protocol and UNCC (United Nations Climate Change Conference) took place by 190 economies in Paris in November-December 2015. It assured that all countries are above the preindustrial level and will reduce global warming by less than 2C°. However, it confirms whether some nations like Pakistan ratify this

agreement or not. The protocol of Pakistan is measured as a landmark for success and a matter of target is very important for the environmental perfections.

There is a need to decrease the level of greenhouse gases to achieve the goal of global warming protection at a certain level. This important question arises that what are the factors of greenhouse gasses emissions and how the economies can decrease the level of emission? To find out the response to the question, we analyze the literature on energy, progress and environment. Several pieces of literature Bakhtyar, Kacemi, and Nawaz (2017); Dogan and Turkekul (2016); Halicioglu (2009); Hossain (2011); Omri (2013); Rafindadi and Ozturk (2015); Shahbaz, Hye, Tiwari, and Leitão (2013); Shahbaz, Solarin, Mahmood, and Arouri (2013) proposed that both the real income (gross domestic product) and energy consumption affects the levels of carbon dioxide (CO2) releases for the various economic groups and also in countries. Additionally, energy consumption sources (for example, renewable and nonrenewable energy consumption) might not have similar effects over to the emissions levels and therefore examined separate impacts of renewable and nonrenewable energy consumptions on the environment. Mostly it is observed that the increase in sources of renewable energy reduces CO2 releases. Current empirical studies Al-Mulali, Ozturk, and Lean (2015); Al-Mulali, Weng-Wai, Sheau-Ting, and Mohammed (2015); Atici (2009); Gökmenoğlu and Taspinar (2016); Jalil and Feridun (2011); Jayanthakumaran, Verma, and Liu (2012); Nasir and Rehman (2011); Muhammad Atif Nawaz, Azam, and Bhatti (2019); Tang and Tan (2015) examined the effect of trade liberalization and financial development on carbon emission level. Furthermore, they used scale, technique and composition effect which rise the trade level and increase the carbon emission level which is also confirmed by (Sulaiman, Azman, & Saboori, 2013).

Specifically, in a scale-effect rise in the trade volume rises the pollution level in the presence of higher the energy consumptions and production level. The composition-effect indicates that a country that specializes in goods production has a relative advantage in some goods. Therefore, a rise in the volume of trade may decrease or increase pollution be contingent on whether goods are produced with energy incentives or not which a country is keeping to produce. Finally, the technique effect states to technology spillover among countries over trade movements. Therefore, the amendment of friendly technologies of the environment in the production of goods can improve the environment.

On the one hand, financial growth may raise the carbon emissions and consumption of energy due to the rise in industrial machines purchasing and inspire equipment by rises of financial network and fall the financial costs. On the other hand, financial growth may raise the business competence and raise the efficiency of energy resulting in carbon emission (CO2) and a fall in energy consumptions (Dogan & Turkekul, 2016). The net effect of trade and financial expansion on carbon releases could be either negative or positive depending on which one is more dominating. According to table 1 and figure 1, from 1990 to 2018, there exists an increasing trend in carbon emission, trade and financial development in Pakistan. From 1990 to 1996 there increase very much which is also seen in the table and figure 1, after that there increase in the decreasing rate in carbon release and monetary development and trade move to decrease. Hence from the table and graph concluded that there exists a positive theoretical connection between the carbon release and trade and monetary development in Pakistan.

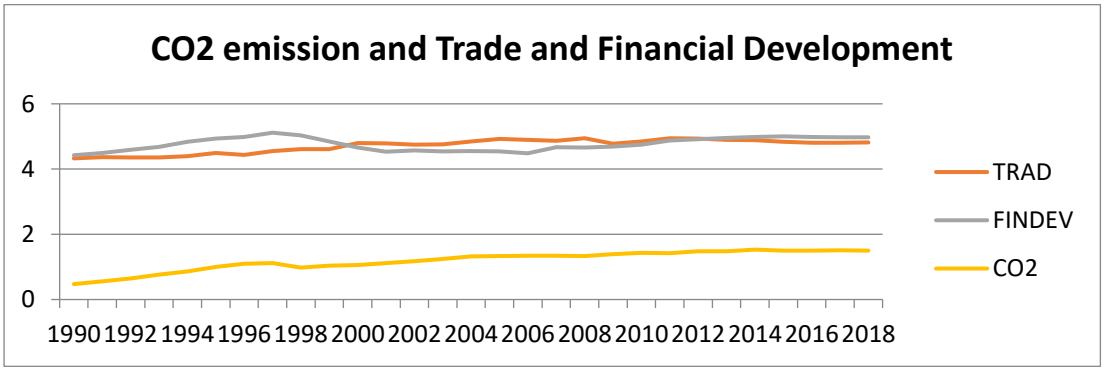

Figure-1: Theoretical relationship amongst CO2 emissions, Trade and Financial Developments

Table 1
Theoretical relationship amongst the Carbon emissions & Trade and Financial Developments

Years	TRAD	FINDEV	CO2	Years	TRAD	FINDEV	CO2
1990	4.327866	4.423277	0.473455	2005	4.926194	4.541484	1.330509
1991	4.362731	4.489717	0.555874	2006	4.898487	4.487586	1.342808
1992	4.356127	4.589747	0.64129	2007	4.866558	4.666853	1.338793
1993	4.353445	4.682219	0.761659	2008	4.944759	4.66117	1.33352
1994	4.397518	4.83373	0.860196	2009	4.781386	4.691196	1.386801
1995	4.497098	4.932939	0.996932	2010	4.846157	4.751411	1.434046
1996	4.434075	4.985742	1.097861	2011	4.939322	4.872699	1.416364
1997	4.554424	5.11502	1.116944	2012	4.93072	4.914352	1.475285
1998	4.607571	5.033086	0.981564	2013	4.893407	4.958381	1.482448
1999	4.612209	4.84982	1.039261	2014	4.881176	4.980618	1.530476
2000	4.798249	4.655119	1.057609	2015	4.835682	5.006449	1.496372
2001	4.78972	4.533443	1.119291	2016	4.80426	4.987594	1.503303
2002	4.744669	4.573364	1.179124	2017	4.808311	4.976623	1.510159
2003	4.759545	4.544726	1.246769	2018	4.814676	4.973915	1.503294
2004	4.847427	4.555398	1.31952				

Though pieces of literature studied the effects of energy consumptions, income, financial growths, and trade, for many countries and also for Pakistan. In this study, we use disaggregated energy consumption like renewable and nonrenewable energy use with the presence of trade liberalization and financial expansion for Pakistan. For this purpose, use the time series data for Pakistan from 1990 to 2018. Moreover, apply the ADF and PP test to check the order of integration of the indicators and then use the ARDL model for estimating the long and short-run estimates of exogenous indicators to environmental degradation in Pakistan.

Therefore, the findings of the study give more dependable and robust results by using suitable econometrics techniques. Additionally, most of the studies use collective consumption of energy in their studies and therefore by sources, they are unable to find out the impacts of energy consumptions. Thus, our research is to inspect the influence of nonrenewable and renewable energies consumptions, real income, trade and also financial development on (CO2) carbon dioxide emission by applying (EKC) Environmental-Kuznets-Curve assumption for Pakistan.

However, data taken from the (World Bank, 2020) and according to that, there exists a cooperative association amongst the Carbon emission, economic development and renewable energy consumptions which shows in Figure 2. The third and last neutral research is to present an extensive examination in the next section on energy, growth and environmental works. Data and model explored in the third section, the fourth part of this study based on a discussion of cross-section and heterogeneity, methodology and findings of the study is defining in the fifth section, sixth and last part based on conclusion and policy recommendations.

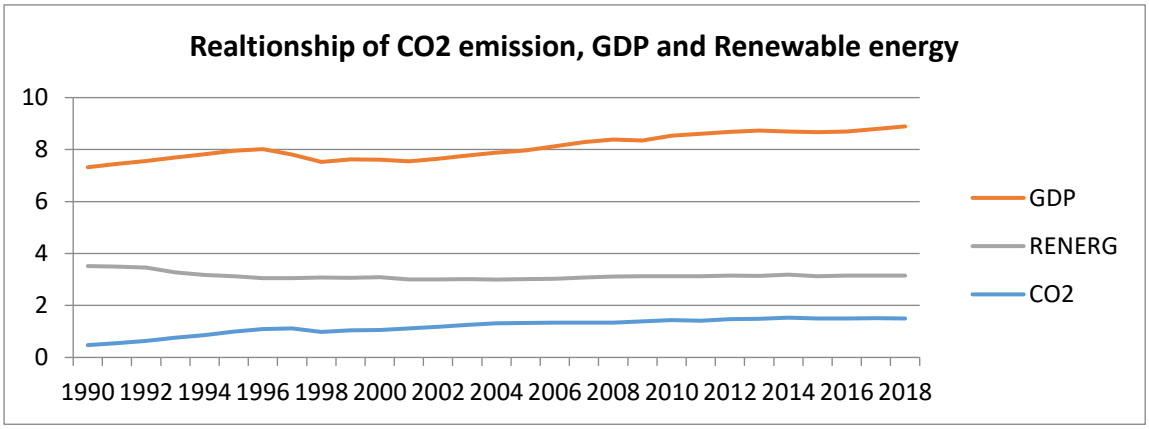

Figure 2: Relationship of CO2 emissions, GDP and Renewable energy

2. Review of the Literature

Many researchers explored the relationship between the growth-energy-environment. The literature review section is shared into three parts for more clarity about the existing literature. The first part defines the association among real income or financial growth, aggregation energy consumption, and CO2 releases (Nasir & Rehman, 2011; Say & Yücel, 2006). Some of those Say and Yücel (2006); Shahbaz, Nasreen, Abbas, and Anis (2015) do not find the validation of the E K C framework. In contradictory, the E K C framework does not support for U S A (Dogan & Turkekul, 2016; Soytas, Sari, & Ewing, 2007), Turkey (Halicioglu, 2009), Cambodia (Al-Mulali, Ozturk, et al., 2015), Russia (Pao, Yu, & Yang, 2011), Tunisia (Farhani & Ozturk, 2015), G7 countries (Ajmi, Hammoudeh, Nguyen, & Sato, 2015), the Middle-East countries, (Ozcan, 2013), O E C D countries, (Dogan, Seker, & Bulbul, 2017), BRIC countries (Saboori & Sulaiman, 2013) Indonesia, Malaysia and Philippines (Saboori & Sulaiman, 2013). On another side, the E K C theory confirmed for the Singapore & Thailand (Saboori & Sulaiman, 2013), Association of the Southeast-Asian Nation (A S E A N) (Heidari, Katircioğlu, & Saeidpour, 2015; Lean & Smyth, 2010), Italy and Denmark (Acaravci & Ozturk, 2010), Central & Eastern-Europe (Atici, 2009), E U countries (Kasman & Duman, 2015), Middle East and North Africa Tunisia (Shahbaz, Khraief, Uddin, & Ozturk, 2014), Pakistan (Nasir & Rehman, 2011) and Vietnam (Tang & Tan, 2015).

One of the present works, Say and Yücel (2006), examined the nexus amongst the energy consumptions, the carbon releases, the population also economic development for Turkey of the time-period 1970 to 2002, and findings revealed that economic developments and the energy consumptions rise emissions level. Validation of the EKC theory, Soytas et al. (2007) inspected the association among the real-incomes, (CO2) carbon dioxide emission, a square of the real-incomes, trade and the energy consumptions for Turkey by using the ARDL (Autoregressive Distributed-Lag) technique over the time period of 1960 up-to 2005 and specifies that, rise in trade and consumptions of energy lead to carbon releases and the EKC framework is invalid. At the same time Gökmenoğlu and Taspinar (2016); Seker, Ertugrul, and Cetin (2015) discovered the sign of the EKC framework for Turkey and also find out that environment degradation rises due to energy consumption. Additionally, one of the new studies Muhammad A Nawaz and Hassan (2016); Soytas et al. (2007) displayed that the level of emissions increases due to the consumption of energy, and by using the causation approach for the USA the EKC is not valid for the time period from 1960 to 2005.

The modern study also revealed a similar deduction for the USA, and additionally define that trade liberalization reduces carbon releases while emissions increases due to urbanization by applying structural break, the Zivot-Andrews and the ARDL technique overtime period from 1960-2010. In the case of China, Jalil and Feridun (2011); Jayanthakumaran et al. (2012) showed that the level of pollution increases due to the consumption of energy. Moreover that by utilizing the nasty group-estimations, urbanization and the trade increased the levels of emissions (Dogan & Turkekul, 2016). They expressed that financial development causes environmental improvement while CO2 emissions rise due to trade openness by applying the A R D L -model from the duration from 1953 up to 2006. According to this researches, Lean and Smyth (2010) examined the association among the real-outputs, square of the real-outputs, the energy consumptions and CO2 releases for the A S E A N . By employing dynamic-ordinary-least-squares (D O L S) and the Johansen cointegration tests overtime the period from 1980-2006 and displayed that the environmental Kuznets curve basis is lawful and rise in energy consumption increases pollution. Furthermore, the research Heidari et al. (2015) concluded similar findings for ASEAN. Additionally, Kasman and Duman (2015) inspected the emission level, the real incomes, the square of the real incomes, urbanization, trade & energy consumption for the long run for EU countries for the time 1992-2010. By employing fully adapted ordinary-least-squares (F M O L S), the Pedroni cointegration test and specifies that trade, urbanization and energy-consumptions hinds to higher pollutions.

The second group of studies discovers a robust connection between the economic developments and energy-consumptions by sources for several countries and areas. Maybe, moved from the B group, the last and C group of studies given in third part studies the

nexus among the real-incomes, energy consumptions by the nonrenewable and renewable energies and CO2 releases. It is essential to explain that the numbers of literature in the C group are lesser as compared to the first group. However, as in the first group of studies, there are few studies in which the EKC hypothesis is not present (Baek & Pride, 2014; Bento & Moutinho, 2016; Chiu & Chang, 2009). Additionally, the EKC framework examined and valid for the panel of 27 advanced countries (Al-Mulali & Ozturk, 2016), MENA countries (Farhani & Shahbaz, 2014), OECD countries (Shafiei & Salim, 2014), Turkey (Bölük & Mert, 2015), France (Iwata, Okada, & Samreth, 2010) and Kenya (Al-Mulali, Solarin, & Ozturk, 2016). At the same time, the EKC framework does-not lawful for the E U countries & Vietnam. By employing DOLS, the F M O L S and Pedroni cointegration test (Jebli, Youssef, & Ozturk, 2016) revealed that the renewable-energy reduced carbon (C O2) releases for the OECD countries. The research (Shafiei & Salim, 2014) find out similar results for the OECD-economies by employing Johansen-cointegration tests with GMM (generalized-methods of the moment) overtime period from 1980 up to 2011. By applying ordinary least square (O L S) with the fixed-effect during the time period from 1980 up-to 2008 agrees that both nonrenewable and renewable energy consumption rise the environment degradation level of European Union economies. Besides this (López-Menéndez, Pérez, & Moreno, 2014) disclosed that renewable energies reduce pollution of European-Union-countries for the time period from 1996 up to 2010 by using the O L S with random and fixed-effect.

The study Farhani and Shahbaz (2014) examined nexus among the real output, CO2 releases, the square of the real-output, renewable and nonrenewable energies for the M E N A countries by employing DOLS the F M O L S and Pedroni cointegration test ended the time period 1980-2009 and showed that nonrenewable and renewable energy consumption rises the carbon releases level. Bölük and Mert (2015) inspected that environmental improvement increases renewable energy by employing A R D L estimation technique ended time duration 1961-2010 for the case of Turkey. Al-Mulali et al. (2016) examined the effects of the trade-openness, real income, urbanization, financial growth, nonrenewable and the renewable energy-consumptions for Kenya for time duration from 1980 up to 2012 by employing the A R D L model and displayed that, financial progress and renewable energies consumption reduces the CO2 releases whilst trade nonrenewable energies and the urbanization tip to higher pollution. Specifically, Iwata et al. (2010) examined that the trade coefficient is not significant whereas (Al-Mulali & Ozturk, 2016; Al-Mulali, Ozturk, et al., 2015; Al-Mulali, Weng-Wai, et al., 2015; Halicioglu, 2009; Nasir & Rehman, 2011) defined that, the trade openness increases the pollution-levels, and(Al-Mulali, Ozturk, et al., 2015; Hossain, 2011; Jayanthakumaran et al., 2012; Jebli et al., 2016; Shahbaz, Hye, et al., 2013) specified that trade reduces pollution. Additionally, (Dogan & Turkekul, 2016) revealed that the financial development coefficient is not significant (Farhani & Ozturk, 2015; Pao et al., 2011; Seker et al., 2015) inspect that environmental degradation rise due to financial development; other different, (Al-Mulali & Ozturk, 2016; Al-Mulali, Weng-Wai, et al., 2015; Shahbaz, Hye, et al., 2013) show that level of releases decreases by financial development.

This study is based on the third group and the study aims to estimate the nexus among renewable energy, nonrenewable energy, real-income level, the square of the level of income, trade and also financial development. Also, to explore the existence of the EKC framework for Pakistan by employing cross-section dependence and various estimation techniques. Therefore, this study applies the Auto Regressive Distributive lag (ARDL) methodology within the presence of ARDL bound test for cointegration and Augmented Dickey-Fuller and Phillips Perron unit root test.

3. Data and Methodology

According to (Lean & Smyth, 2010; Ozcan, 2013; Pao et al., 2011) studied the connection between energy production & the environment in the context of the EKC in which carbon productions have decreased by real incomes, on quadratic-incomes and the overall use of energy (EGY). Besides, some studies (Farhani & Shahbaz, 2014) decomposed energy consumptions by source, that study examined the environmental energy growths connection based on the EKC in which the level of CO2 is reduced by the income level (GDP), quadratic income level (GDP^2), the consumptions of the renewable-energies

(RENERG) and boosts the production of CO2 by the use of the nonrenewable-energy (NRENERG).

The E K C -model adopts that environmental degradation increases by the income in the early stage of the economic growths but after a shift, the increases in the income hints towards an upgrading in an environment (Grossman & Krueger, 1991). It implied that E K C theory assumes the quadratic association amongst economic development and also the environment-pollutions. Furthermore, the research (Stern, 2004) also directs that the elasticity of the CO2-emission concerning production is the same in different countries. However, the carbon releases can differ between economies, at the given production levels. The basic E K C -model (model-1) may be represented as follows:

$$\mathrm{CO2} = \mathrm{f}\,(\,\mathrm{GDP}, \mathrm{GDP}^2, \mathrm{RENERG}, \mathrm{NRENERG}) \tag{1}$$

Recent studies, in particular (Atici, 2009; Jayanthakumaran et al., 2012; Jebli et al., 2016; Nasir & Rehman, 2011; Shahbaz et al., 2014), affirm that the trade opening (T R) could explain the change in the levels of the carbon releases also includes it in basic E K C model. Consequently, the modified E K C -model (model-2) can be written as:

$$\mathrm{CO2} = \mathrm{f}\,(\,\mathrm{GDP}, \mathrm{GDP}^2, \mathrm{RENERG}, \mathrm{NRENERG}, \mathrm{TRAD}) \tag{2}$$

Additionally, the trade openness, many recent studies (Ajmi et al., 2015; Al-Mulali et al., 2016; Jalil & Feridun, 2011; Seker et al., 2015; Shahbaz et al., 2015), discussed the importance of financial development-FD to determine levels of the carbon production and further it also includes in the basic EKC theory and the model will become like this;

$$\mathrm{CO2} = \mathrm{f}\,(\,\mathrm{GDP}, \mathrm{GDP}^2, \mathrm{RENERG}, \mathrm{NRENERG}, \mathrm{TRAD}, \mathrm{FINDEV}) \tag{3}$$

The econometric model will become like this,

$$\mathrm{CO2}_t = \varphi_o + \varphi_1 \mathrm{GDP}_t + \varphi_2 \mathrm{GDP}_t^2 + \varphi_3 \mathrm{RENERG}_t + \varphi_4 \mathrm{NRENERG}_t + \varphi_5 \mathrm{TRAD}_t + \varphi_6 \mathrm{FINDEV}_t + \epsilon_t \tag{4}$$

Where t represents time; ϵ_t and indicates a normally distributed error term; $\varphi_1, \varphi_2, \varphi_3, \varphi_4, \varphi_5$ & φ_6 are the consistent approximations of relevant constructs. If E K C theory remains valid, we could expect that, $\varphi_1 > 0$, & $\varphi_2 < 0$. In adding, φ_3 should be negative, while 4 should be positive optional by the state-of-the-art. Estimate of φ_5 & φ_6 could be better or fewer than the zero dependence on the net effect of the trade opening & financial expansions on the carbon releases. As, the (CO2) carbon dioxide in tones; GDP is the gross-domestic-product per capita in the U S dollars; TRAD is the trade measured as the sum of the imports and exports of the goods & services as the percentage of GDP; FINDEV describes the financial developments measuring in the-credit within the private-sector as the percentage of GDP; RENERG is the consumption of renewable energy '%' of the total final-energy consumptions; NRENERG is the consumption of non-renewable energy from fossil fuels % of the overall. After that, (Bölük & Mert, 2015; Farhani & Shahbaz, 2014; Jebli et al., 2016) used electricity as an indirect sign of energy consumption. The yearly time-series data range starts from the year 1990 up to 2018 for Pakistan. Data on CO2, RENERG, NRENERG, GDP, TRAD and FINDEV took from "Indicators of World Development" (World Bank, 2020).

The data utilized in this research are converted in the natural logarithms to understand coherent estimates such by way of elasticity of the response-variables (CO2 emission) compared to exogenous-variables (GDP, GDP^2, RENERG, NRENERG, TRAD, and FINDEV), then the econometric form appear like;

$$\log\mathrm{CO2}_t = \varphi_{o_t} + \varphi_{1_t} \log\mathrm{GDP}_t + \varphi_{2_t} \log\mathrm{GDP}_t^2 + \varphi_{3_t} \log\mathrm{RENERG}_t + \varphi_{4_t} \log\mathrm{NRENERG}_t + \varphi_{5_t} log\,\mathrm{TRAD}_t + \varphi_{6_t} log\,\mathrm{FINDEV}_t + \epsilon_t \tag{4}$$

3.1 The Unit-root test

Table 2
The Unit-root test

Variables	Augmented Dickey-Fuller		Phillips-Perron	
CO2	-2.212	0.465	-2.535	0.310
D(CO2)	-9.929***	0.000	-4.184**	0.014
FINDEV	-2.365	0.388	-1.956	0.599
D(FINDEV)	-2.868*	0.063	-2.833*	0.067
GDP	-2.680	0.252	-0.658	0.842
D(GDP)	-3.317*	0.085	-3.234*	0.099
NRENERG	-3.202*	0.104	-4.907	0.003
D(NRENERG)	-------	------	-------	------
RENERG	-2.562	0.299	-2.797	0.210
D(RENERG)	-4.336**	0.010	-4.372**	0.009
TRAD	-1.212	0.888	-0.861	0.947
D(TRAD)	-5.451**	0.001	-9.110***	0.000

This empirical work uses ADF & the PP unit-root test. The result of the ADF and PP unit tests are displayed in the table-2. Both of them concludes that carbon releases, GDP, consumption of renewable energies, consumption of nonrenewable energies, trade, & financial expansion contains the root at the level and becomes stationary at the first differences. Non-renewable energy remains stationary at the levels. In other words, we can close that CO2, GDP, RENERG, NRENERG, TRAD and FINDEV are I (1) and NRENERG has I (0) integration level. Data must be fixed or co-integrated at their stages to allow researchers to judge statistically and economically expressive estimates. Since CO2, GDP, RENERG, NRENERG, TRAD, and FINDEV include root units at their levels.

3.2 Autoregressive Distributive Lag (ARDL) Model

$$lnCO_{2_t} = \varphi_o + \sum_{i=1}^{p} \varphi_1 \Delta lnCO2_{t-1} + \sum_{i=0}^{p} \varphi_2 \Delta lnGDP_{t-1} + \sum_{i=0}^{p} \varphi_3 \Delta lnGDP^2{}_{t-1} + \sum_{i=0}^{p} \varphi_4 \Delta lnRENERG_{t-1} + \sum_{i=0}^{p} \varphi_5 \Delta lnNRENERG_{t-1} + \sum_{i=0}^{p} \varphi_6 \Delta lnTRAD_{t-1} + \sum_{i=0}^{p} \varphi_7 \Delta lnFINDEV_{t-1} + \varphi_8 lnCO2_{t-1} + \varphi_9 lnGDP_{t-1} + \varphi_{10} lnGDP_{t-1}^2 + \varphi_{11} lnRENERG_{t-1} + \varphi_{12} lnNRENERG_{t-1} + \varphi_{13} lnTRAD_{t-1} + \varphi_{13} lnFINDEV_{t-1} + \epsilon_t \quad (5)$$

Where 'Δ' indicates first-difference-term and ϵ_t is perturbation-term, which is assumed as having an average value of the zero also, which is not correlated with exogenous variables. A R D L approach is based on the 'F' statistic used to study the presence of the cointegration-between variables examined.

4 Results and Discussion

This study uses the ARDL bound test to verify the co-integration in the model and estimates F-statistics are more significant than the lower and upper bound of the significance level. That means this reject the null hypothesis and validate the co-integration among the exogenous and endogenous indicators of the model.

Table 3
ARDL Bound test

F-statistic	9.440394	6
Critical bounds		
Significance	I_0 Bound	I_1 Bound
5%	2.04	3.24
1%	2.66	4.05

After confirming that carbon emissions, income level, quadratic income level, renewable energy, nonrenewable energy, trade, and financial expansion are co-integrated, it is unusual for researchers to define consistent estimates of the long- and short-term exogenous indicators like (GDP, GDP^2, RENEG, NRENEG, TRAD, FINDEV).

Results of ARDL estimators are presented in Table-4. Since natural logarithm forum is used to simplify the long-run estimates of income (GDP), squared of income (GDP^2), the nonrenewable-energy consumptions (NRENERG), the renewable energy consumptions (RENERG), the trade (TRAD), also financial growth (FINDEV) to the carbon emission level.

Table 4
Short and Long-run ARDL estimates

Variables	Coefficients	SE	t-stats	Prob.
D(CO2(-1))	0.4588**	0.1922	2.3874	0.0440
D(GDP)	8.7131**	1.9505	4.4671	0.0021
D(GDP(-1))	5.4482**	1.6042	3.3961	0.0094
D(GDPSQ)	-0.5235**	0.1191	-4.3973	0.0023
D(GDPSQ(-1))	-0.3975*	0.1055	-3.7678	0.0055
D(RENERG)	1.8578*	0.6363	2.9195	0.0193
D(RENERG(-1))	0.4847	0.3661	1.3239	0.2221
D(NRENERG)	7.9076**	2.1755	3.6349	0.0066
D(NRENERG(-1))	-2.9146**	0.9632	-3.0260	0.0164
D(TRAD)	0.3053**	0.1042	2.9303	0.0190
D(TRAD(-1))	0.6553**	0.1897	3.4543	0.0086
D(FINDEV)	-0.1839	0.1295	-1.4208	0.1932
ECT(-1)	-1.5990**	0.2183	-7.3256	0.0001
Long run ARDL estimates				
GDP	2.0111***	0.3586	5.6079	0.0005
GDPSQ	-0.1630***	0.0214	-7.6040	0.0001
RENERG	-0.3393**	0.1011	-3.3564	0.0100
NRENERG	2.8060***	0.3526	7.9575	0.0000
TRAD	-0.4510*	0.1277	-3.5308	0.0077
FINDEV	-0.4718***	0.0803	-5.8793	0.0004

Note: ***,** *and* * *show* 1%, 5% & 10% *level of significance correspondingly.*

Results indicate that the effect of GDP is positive while GDP-square reduces the level of carbon emission level. Furthermore, the marginal effect of GDP towards CO2 significantly indicates that it boosts the environmental degradation level and becomes negative as they grow to the long term. In the other words, as key renewable-energy countries exceed the income threshold, the increase in the real incomes hints at the environmental-progresses. This implies that the E K C assumption remains to validate for main countries examined for renewable energies. The presence of E K C theory is consistent as per (Al-Mulali & Ozturk, 2016; Al-Mulali et al., 2016; Chiu & Chang, 2009; Pao et al., 2011).

As regards the environmental-effect of the energy consumptions by causes, the rise in the level of renewable-energy attenuates carbon-CO2 releases while the increase in the consumption of nonrenewable-energy stimulates levels of the releases. Conversely, 1% rise in the R E C decreases levels of releases by 0.3393%, 1% rise in NREC boosts the level of the CO2 by 2.8060%. The results are similar with the (Al-Mulali & Ozturk, 2016; Al-Mulali, Ozturk, et al., 2015; Al-Mulali et al., 2016; Bento & Moutinho, 2016) they explained that renewable energies lead to environmental signs of progress, and (Al-Mulali & Ozturk, 2016; Al-Mulali et al., 2016; Bento & Moutinho, 2016; Jebli et al., 2016; Rafindadi & Ozturk, 2015) argued that, use of the nonrenewable energies hints to the environmental-deprivation. So, from these results, scientific institutions and research organization and public sectors modified their energy resources towards renewable energy resources and maintain them. The other option is to make policies to aware the public and citizens of the country about renewable energy factors and clean the environment.

Elasticity of the CO2 releases with-respects to the trade & financial expansions is -0.45% & -0.47% correspondingly. This suggests that increased-trade liberalization with financial expansion decreases the carbon releases in the main renewable-energy countries. As discussed in the first section, trade & financial expansion can have a positive or negative influence on the environment. Results of this confirm that trade liberalization and financial growth both decrease the level of environmental degradation.

This makes sense because also developing countries, particularly, have to make good progress in discovering advanced technologies in recent decades, and countries studied seem to be benefiting from technological spillovers through the trade and financial networks. In addition, the main renewable energy countries are likely to create and export nonenergy consuming also environmental welcoming goods & import dirty environmental harmful goods. Negative estimates of the trade are similar to these studies (Jebli et al., 2016; Sulaiman et al., 2013; Tang & Tan, 2015). Additionally, the negative effect of financial development on carbon releases is similar as of (Al-Mulali et al., 2016).

5. Conclusion & Policy Recommendations

The objective of current experiential research is to, discover the environmental effects of the incomes, sources of energy consumptions, trade, also financial growth to guide the nation to manage the increase in carbon releases. Therefore, we give attention to long term dynamic association between the C O 2 releases, incomes (GDP), quadratic income (GDP^2), renewable-energy consumptions (RENEG), nonrenewable-energy consumptions (NRENERG), the trade (TRAD) & financial developments (FINDEV) within the presence of E K C -framework for Pakistan for period 1990-2018. In addition, we use the ADF and PP unit-root tests to verify the order of integration and the results and policy recommendations can be short as follows: The results of the ADF and PP test indicates that NRENERG has stationary at the level and other remaining are stationary at first difference.

ARDL estimators indicate that rises in RENERG, TRAD, and FINDEV help to boost the environmental improvements while rises in NRENERG cause environmental humiliation for major renewable-energy countries. E K C theory revealed indicates that the increase in the real-productions hints to the environmental progresses after the income threshold.

The countries must plan to raise their GDP gross-domestic-product. Since the countries could presently produces-energy from nonrenewable sources at the lower-costs than renewable energies, they must help university's researchers, research organizations and the public sector to move towards renewable energy sources. Consequently, implementations of the main renewable sources in the energy combination could also become economically viable for the countries.

It is important to keep future investments in the renewable energy sector from important breakdown into oil prices and additional measures must take in the countries, mainly in developing and non-developed countries (for example, tax reduction and subsidies for consumption and production of renewable energies).

As the Paris Protocol proposes, developed countries must play their role in providing financial support to developing and non-developed countries for adaptation of renewable energy and help them to move towards renewable energy resources. The utilization of renewable energies and acceptance of renewable energy technologies must become further introduced into production processes. Increased trades and financial progress could also help the countries (through-technological spillovers) to adopt and also utilize advanced environmental technologies.

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