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Journal homepage: www.publishing.globalcsrc.org/reads**CO2 and Environment Change Evidence from Pakistan**¹Javeria Masood, ²Fatima Farooq, ³Muhammad Saeed¹M.phil Economics, School of Economics, Bahauddin Zakariya University Multan, Pakistan,
jmasood46@gmail.com²Lecturer, School of Economics, Bahauddin Zakariya University, Multan Pakistan³Department Accounting and Finance, School of business, Superior University Lahore, Pakistan**ARTICLEDETAILS****History***Revised format: Nov 2015**Available online: Dec 2015***Keywords**ARDL,
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I12, I15, I18

ABSTRACT

A safe and healthy environment is a basic right of all living bodies but in current era pollution is at peak. The present study applied bound test based co-integrating technique using annual time series data from 1970-2014 for exploring major determinants of Environmental degradation. Present study included four determinants were energy consumption, gross domestic products, FDI and population growth. Finding of the present observed a significant relationship among energy consumption, GDP, population growth and environmental degradation in short run and long-run. However, foreign direct investment has a positive and significant association with environmental degradation at 10% level of significance both in short and long-run. The econometric findings suggest that Pakistan has to sacrifice use of energy consumption, to have a safe and healthy environment for better livings; Pakistan should adopt other way of energy like solar energy .While foreign direct investment must be used for pollution free machine or pollution free projects so that we can have clean Pakistan. Government of Pakistan should care about green policy and should spread awareness in public so that population growth should not be a problem of environmental degradation. This research study made a unique participation in emergent body of empirical studies on practices of environmental awareness in Pakistan by using bounds test based co-integration technique.

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Corresponding author's email address: jmasood46@gmail.com**Recommended citation:** Masood, J., Farooq, F., and Saeed, M. (2015). CO2 and Environment Change Evidence from Pakistan. *Review of Economics and Development Studies*, 1 (2) 57-72DOI: <https://doi.org/10.26710/reads.v1i2.116>**1. Introduction**

A safe and healthy environment is the basic right of all living bodies, previous generations hand over, this earth safe and sound to us. But in new times many things creating troubles that are not good for the safety of earth where we live or for space where we breathe. The scale of toxic waste of the atmosphere

has now touched a shocking level (Pramanik, Shil et al. 2007). In 19th century in the era of fifties and sixties, peoples started to think about the environment degradation because of that is the time when peoples activities started to damage environment .Few events which made peoples interested in environment protection japons mercury poisoning, smoke pollution from London and a great oil leakage by Terry Canyon accident (Bassey, Effiok et al. 2013)

It is observed that climate change is most problematic issue for the current century, for whole over the world particularly for developing countries because of; these countries have low income level and low ability to adopt environmental change. (Abidoeye, Herriges et al. 2012).World largest organizations like United Nations (UN) or the World Economic Forum (WEF), are trying to save nature and economy from opposing influence of global warming and climate change . (Farhani, Chaibi et al. 2014).Corbin dioxide emissions (CO₂) is accounted for major participant for pollution , 92% of the entire GHG (green house gas) emissions (Farhani, Chaibi et al. 2014).A research study claimed that Corbin dioxide is accounts for 58.8% of total greenhouse gas emission. The main reason for studying CO₂ emissions is that they play a focal role in the current debate on environment protection and sustainable development.

There are many researchers, who worldwide studied energy consumption, GDP ,FDI, population growth and Corbin dioxide emissions, many of them argued that energy consumption increase GDP of the country, while few of them argued no doubt energy consumption increase GDP but it also become the reason of CO₂ emissions .Whereas many researchers claimed that CO₂ emissions trend varies in developed and developing countries, in poor countries if GDP increase ,it also a source of CO₂ emissions , but in case of developed countries in the beginning pollution increase but latter pollution tends to decrease due to increase in income level of countries .The following is a brief snapshot of worldwide conducted studies on energy consumption , GDP and CO₂ emissions.

Huang, Hwang et al.(2008) conduct a research study on energy consumption and GDP on the base of income level .They argued environment quality improve in high level group because of when their income goes to up they starts efficient energy use and CO₂ emissions reduce. Many authors remain busy in early decades to give empirical and theoretical answer of this problem and the supreme answer was the Environmental Kuznets Curve Hypothesis (EKC). The EKC (Grossman 1995; Torras and Boyce 1998) explored relationship among ecological quality and energy, they argued an inverted-U shape relation between environment quality and income level, they claimed that in developed countries at start ecological quality degrades but eventually improve with earnings level increment.

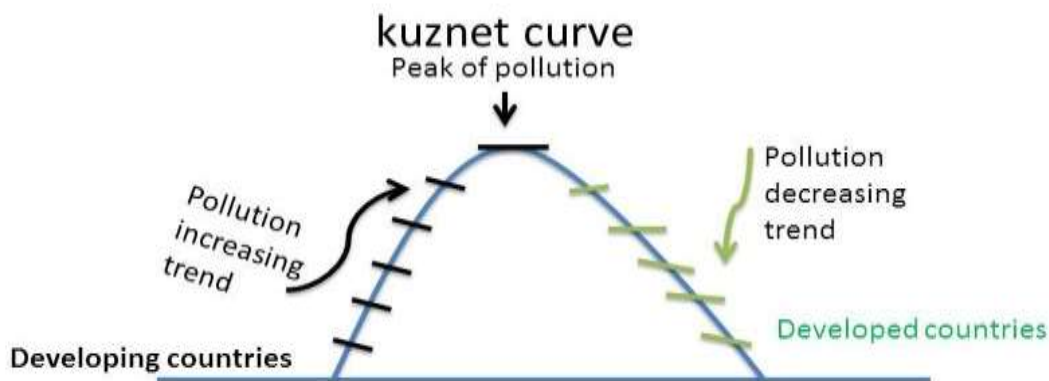
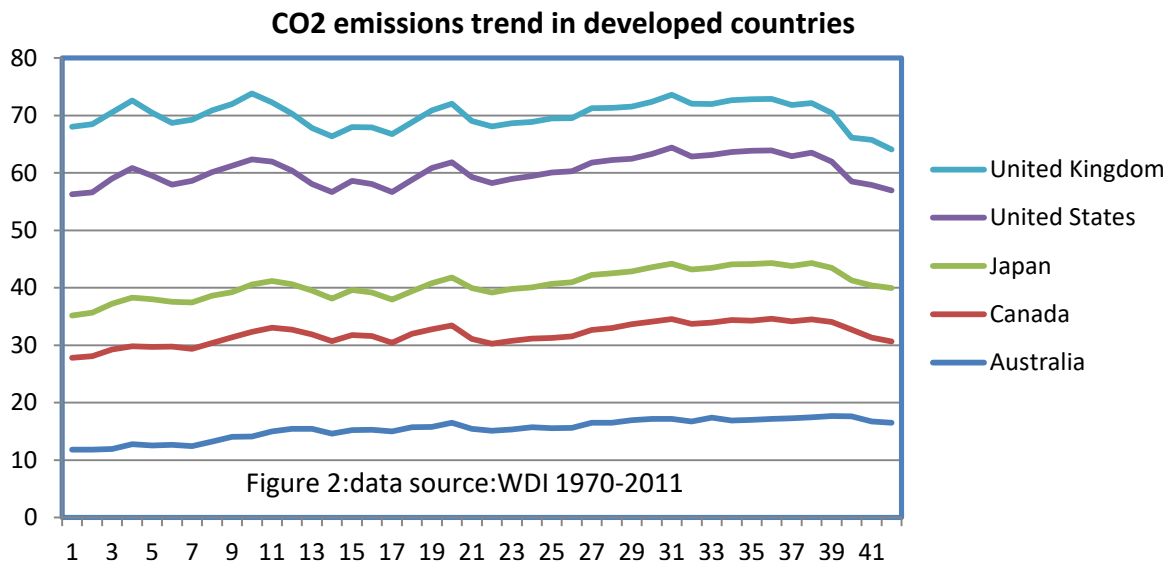


Figure 1, is known as kuznet curve , which explain that pollution in poor countries increase with the production of goods , its means increase in production increase in pollution , further, above figure is also indicating that pollution increase at start but gradually pollution comes down in developed countries with increase of production of goods(Galbraith 2007). Figure 2, is indicating the trend of CO2 in developed countries. Five high income level developed countries are chosen randomly. The following graph is indicating zigzag CO2 emissions, it is important to know that CO2 emission is not going straightly upward. This graph is showing that at initial level CO2 emission increase but ultimately decrease because of developed countries ceased product pollution intensive goods and they import same product from other countries with less preventive ecological shield laws. (Grossman and Krueger, 1995)



Flowing figure 3. Is showing the results of GDP trend in developed countries. The graph is elaborating that all developed countries GDP is increasing with the passage of time .Hence, we can easily observed that even GDP of developed countries increase but their environmental quality improving, it may be a results of high level technology . Hoi, Heshmati et al. (2010) observe investigated the existence of the environmental Kuznets curve (EKC) for (CO2) emissions and its causal relationships with economic growth and openness by using time series data. The environmental consequences according to openness and economic growth do not show uniform results across the countries. This study indicated that CO2 emission depend on the characteristics of the country. Further Huang, Hwang et al.(2008) explored association among energy consumption and GDP with respect to income levels. The results indicated that environmental development can be perceived in the high-income group because of the efficient energy use and the reduction in CO2 emission

GDP Trend in Developed Countries

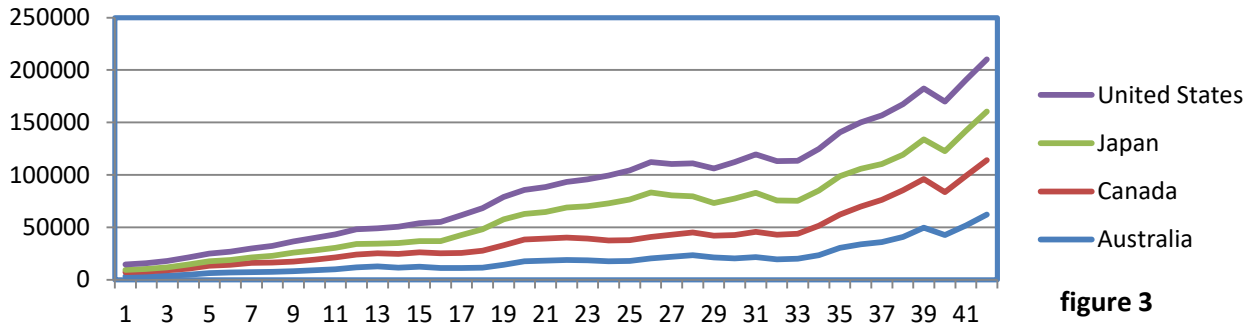


figure 3

Figure 4, is showing the results of CO2 emission of selected developing countries for the period of 1970-2011, graphical line are demonstrating that in developing countries CO2 emissions is continuously increasing , while Sri lanka’s emissions is at top , while Pakistan emission level is low as compare to other countries mentioned in the above graph.

CO2 Emission Trend in Developing Countries

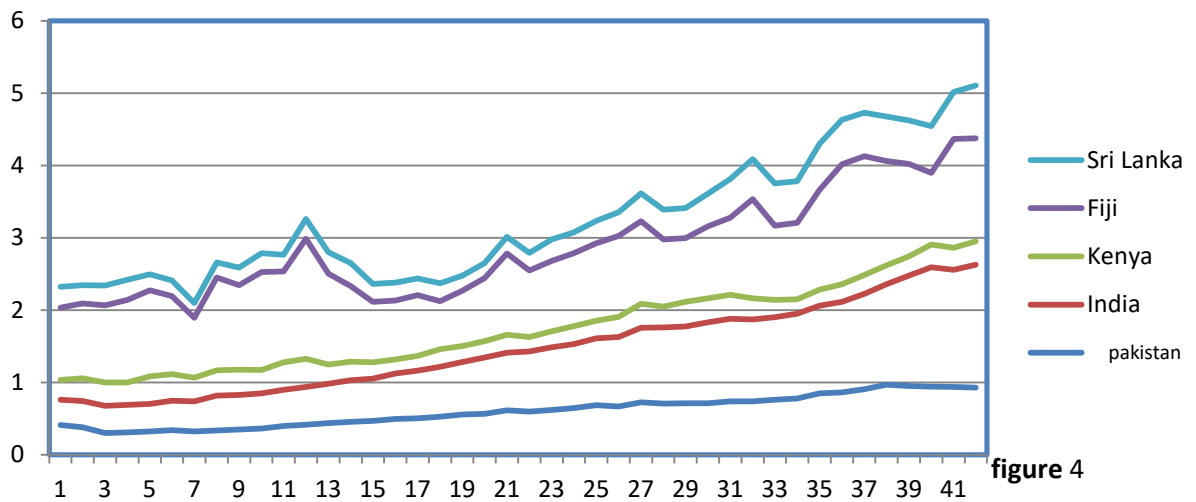


figure 4

Succeeding figure5, is indicating the GDP trend for the selected five developing countries, graphical lines are indicating that GDP of all countries is continuously increasing ,Sri Lanka’s GDP is top while Pakistan’s GDP is at low level, if we compare graphs of CO2 emissions and GDP of both countries with respect to income level ,developed countries fall in high level income and graphical presentation is showing that even their GDP is high but their CO2 emissions is low , while if we talk about the developing (low income) countries ,graphical presentation is demonstrating that those countries which have high GDP ,they have high CO2 emissions .This dilemma with developing countries may be a cause of largely due to their environmental exposure, low income, greater dependence on climate-sensitive sectors and weak capability to adjust to the shifting climate(Abidoye, Herriges et al. 2012)

GDP Trend in Developing Countries

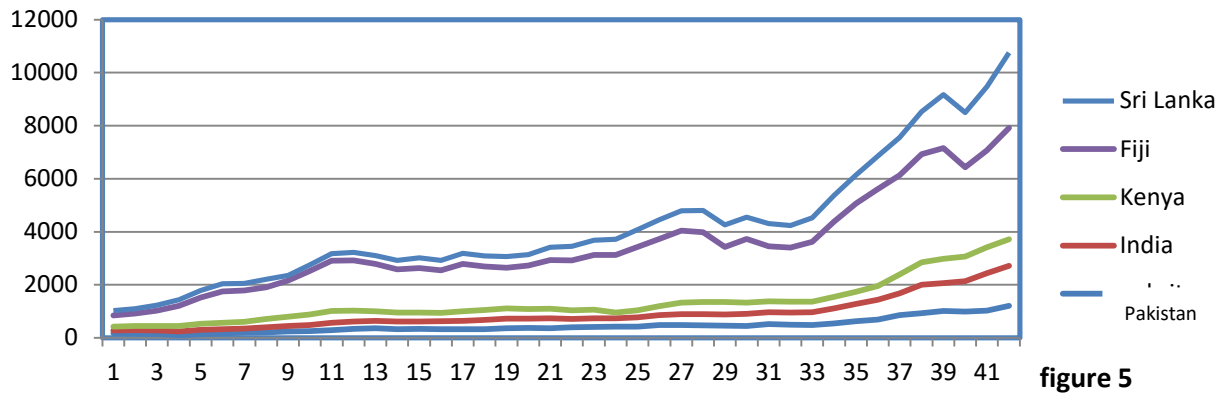


figure 5

Literature exposed that different studies are conducted in developed countries to analyze impact of energy consumption and GDP on Corbin dioxide emissions. In developed countries many studies claimed that kuznet curve exist .While, developing countries are still less focused on this area of research. Pakistan is fall in developing countries, where 21.3% of GDP comes from industrial sector (wiki2014) .Environmental issues are addressing on global plat form, unfortunately this area of research is less focused in Pakistani context.

The significance of this research study is that; this study analyzed energy consumption, GDP and environmental degradation in Pakistani context, because this area of research was les focused in Pakistani perspective. Further this study used unique econometric bounds test based cointegration technique (ARDL approach) which is not frequently used for environmental studies. Pakistan include in developing countries, where update and pollution efficient technology is scarcely used. Thus, it is interesting to investigate impact of energy consumption and GDP on environmental degradation.

Present study is structured in different sections: the second section involves literature review on the oil consumption ,GDP and environmental degradation ; while third segment defines data source and methodology ,whereas fourth part discuss data and analysis .The fifth section reveals main finding and finally, last section elaborate conclusion, recommendation, limitation, and future scope of research.

2. Literature Review

This part of study examines different studies, conducted by various researchers, in different countries. The Prior studies investigated association among energy consumption, GDP and environmental degradation. The relevant literature indicated that different research group used different approaches to measure dependent variables. Most of researcher used granger causality approach, few used fixed effect and random effect model, while some of researchers used panel co-integration etc. Since, the present study is different from all above mentioned approaches because of, this study investigated the affiliation between energy consumption, GDP, FDI, population growth and environmental degradation in Pakistani context through Autoregressive distributed lag approach (ARDL with Cointegrating Bounds).

Soytas et al. (2007) examined the association among income, carbon dioxide and energy consumption. This study discovered income doesn't source of CO2 emissions, further; this study claimed that energy consumption is a object of CO2 emissions in United States. War and Ayres (2010) examined association between energy consumption and GDP; findings revealed that energy consumption does granger Cause to GDP. lee and change (2005) find out link between energy and GDP for Taiwan .They claimed that use of energy is like an engine in long run for GDP but on the other hand , usage of energy Cause harmful for economic growth .Lim, Lim et al. (2014) described connection among oil

consumption, GDP and CO₂ emission. They opined that bi-directional causality running between oil consumption and GDP, on the contrary this study also find bi-directional causality between oil consumption and CO₂ emission.

Chen and Huang (2013) inspected association between CO₂ emission and economic growth; they discovered that there is a long-run relationship among electric power consumption, GDP, energy use and CO₂ emissions. Junky (2011) verified the Environment Kuznets Curve (EKC) theory for 36 rich republics for the era of 1980–2005. The findings indicated unidirectional relationship from per capita GDP to per capita CO₂ emission. He, Huo et al. (2005) attempted to demonstrate the existing status and prediction the upcoming trend of oil demand and CO₂ emissions from the Chinese road transportation sector. They claimed about china that in next two decades china will be largest oil consumer. Drabo (2010) conducted a study having large sample size of rich and poor countries to test link between environmental indicators and economic convergence. Finding of study showed that economic movement negatively affect by environmental deprivation, further, environmental degradation creates difficulties for the poor countries to be developed economically.

Auric, Youssef et al. (2012) investigated the affiliation among carbon dioxide emissions, energy consumption, and real GDP for twelve MENA countries (Middle East and North African). The findings recommended that there is not essential that all MENA republics scarify their development to decrease CO₂ emissions; they may attain CO₂ emissions decline via energy protection devoid of harmful long-run effects on economic growth. Farhani, chaibi et al (2014) examined the energetic association among (CO₂) emissions, output (GDP), energy consumption, and trade. The empirical outcomes exposed the existence of bidirectional causational long-run associations among the variables. In the short-run, there are three unidirectional Granger causality affiliations, which run from GDP, squared GDP and energy consumption to CO₂ Emissions.

Pao and Tsai (2010) inspected dynamic causative associations among chemical emissions, energy consumption and output for a panel of BRIC countries for the era of 1971–2005. This study claimed that in long run energy consumption positively associate with chemical emissions. In addition, study claimed bidirectional long run causality among energy consumption and output and energy consumption to chemical emissions. Apergis and Payne (2009) described in long run energy consumption positively and significantly effect to emissions, whereas real output displays the reversed U-shape pattern linked with the Environmental Kuznets Curve (EKC) theory. On the other hand short-run dynamics specify unidirectional interconnection from energy consumption and real output, correspondingly, to emissions along with bidirectional causality between energy consumption and real output.

Hatzigeorgious, Polatidis et al. (2011) explored causational relationship among GDP, energy intensity and Corbin dioxide in Greece for the time period of 1977-2007. They claimed set of unidirectional and bidirectional casualties among projected variables. Lotfalipour, Falahi et al. (2010) examined association among fossil fuel consumption, economic growth and CO₂ emissions, by using Toda-Yamamoto time series analysis technique in Iran for the time 1967-2007. Finding of the study argued that there is a unidirectional causality running from gross domestic product two proxies of energy consumption (natural gas use and petroleum products) to Corbin dioxide. Further this study suggested no causality in long run running from fossil fuel to CO₂ emission. This study also argued that fossil fuel consumption, CO₂ emissions, petroleum products do not be a source of economic growth.

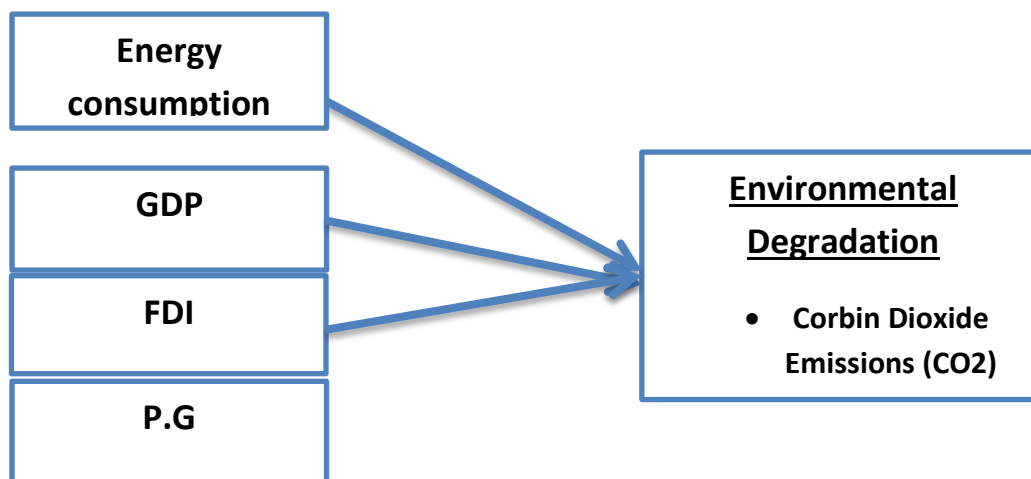
Menyah and wolde-Rufael (2010) conducted a study for the time period of 1965-2006; they inspected long run and casual link among energy use, economic growth and pollutant emissions for South Africa. This study claimed for the short run as well as long run positive and significant relationship among economic growth and pollutant emissions. They also found unidirectional causality successively from

pollutant emission to economic growth; energy consumption to economic growth and energy use to CO₂ emissions. Ang (2009) scanned relationship among energy use, income level, trade openness and Corbin dioxide emissions by consuming more than fifty years data for china .he argued that maximum energy use produce more income and bigger trade openness but are a cause of Corbin dioxide emissions.

Blanco, Gonzalez et al. (2013) examined relationship between fdi and co₂ emissions, they conducted panel study from 18 Latin American countries from 1980-2007. Finding of the study claimed association between fdi and co₂ emissions, thy claimed that there is causality running from fdi to co₂ emissions per capita.Omri (2013) examined relationship between CO₂ emissions, FDI, and economic growth using dynamic simultaneous-equation panel data models for a global panel of 54 countries over the period 1990 –2011.finding of the study claimed of bidirectional causality running from FDI to Co₂ emissions.Yanchun (2010) conduct a study in chine In which he explored link between Fdi and Co₂ emissions ,this study clam that there is negative association between fdi and Co₂ emissions ,but still thy argued it does not that Fdi is not harmful of us.Shaari, Hussain et al. (2014) conducted a panel study and data was collected from 15 developing countries, they found that fid does not have any effect on Co₂ in long run.

(Shi 2001) investigated about Population Growth and Global Carbon Dioxide Emission using data from 93 countries for the time period of 1975-1996. He claimed that population growth is one of the major determinant of Co₂ emissions. (Martínez-Zarzoso, Bengochea-Morancho et al. 2007) observed relationship among population and Co₂ emissions ,using data form European countries .Finding of study found linkage between population and co₂ emissions , further, they suggest population must be taken in account for further climate change.Zhu and Peng (2012) conducted a study in china in which author's observe population change effect on Co₂ emissions for the time period of 1978–2008.Study found changes in consumption level and population structure as major determinant of Co₂ emissions one the other hand population size does not effect on Co₂ emissions. Finding of the study claimed a high correlation among consumption level and Co₂ emissions. Population age, household size effect majorly Co₂ emissions and Urbanization increase Co₂ emissions.

Conceptual Frame Work



3. Data and Econometric Methodology

3.1 Data and data source

Four variables energy consumption, gross domestic product (GDP) and carbon dioxide (CO₂) emissions are used in this study. Annual data is taken from world development indicator, the World Bank (Washington) data base , for the time period of 1970-2014. Present study castoff Corbin dioxide emissions (CO₂) as dependent variable while energy consumption and GDP as explanatory variables .Corbin dioxide is measure in metric tons per capita, energy consumption in kg of oil per capita and gross domestic product (GDP) in per capita (current US\$). Various studies employed these variables in different countries like (Chen and Huang ; Fatai, Oxley et al. 2004; Lee and Chang 2005; Choi, Heshmati et al. 2010; Abidoeye, Herriges et al. 2012; Arouri, Youssef et al. 2012; Lim, Lim et al. 2014).

Table 1. Variable Description

Variable	Description	Units	Source
CO₂	Corbin dioxide emissions	Metric tons per capita	(WDI)
ENU	Energy consumptions	Kg of oil equivalent per capita	(WDI)
GDP	Gross domestic product	GDP per capita (current US\$)	(WDI)
FDI	Foreign direct investment	FDI ,net inflows (% of GDP)	(WDI)
P.G	Population growth	Population growth (annual %)	(WDI)

3.2 Econometric Methodology

Present study is based on positivism research paradigm, which verified findings of previous studies, which are conducted in developed as well as developing countries. Relationship is examined among projected variables through statistical software Eviews 9 .Following statistical techniques are used to analyze data.

3.3 Unit root test: Augmented Dickey Fuller Test

Time series data mostly found non stationary, whereas sationarity in data is most important. There are many researchers who claimed that non stationary data produce spurious results, means non-sense results, Hence to produce valid and to avoid from spurious results data must be stationary (Gujarati and Porter 1999).In the present study stationary of data is check through Augmented Dickey Fuller Test , which is frequently used in research studies. Even though, ARDL techniques has no need to check stationary of data but we have check stationary because of any variable which is stationary at second difference $I(2)$, cannot be include in equation, as any variable stationary at $I(2)$,in this case ARDL produce nonsense results .The major reason of not included $I(2)$ variable in ARDL approach is ,F-statistics value calculated by Pesaran, Shin et al. (2001) and (Narayan 2005) is no longer effective.

3.4 Autoregressive distributed lag approach (ARDL with Cointegrating Bounds)

ARDL approach is introduced by (Pesaran, Shin et al. 1996),(Pesaran and Shin 1998), whereas (Pesaran, Shin et al. 2001) developed it further. This approach got lot of fame due to many econometric advantages as compare to other cointegration methods. This approach does not force that all variables must be cointegrated on same order i.e. $I(1)$, ARDL approach correspondingly noble if all the variables cointegrated of order $I(0)$ or $I(1)$ or even variables projected in model stationary at $I(0)$ & $I(1)$ (Pesaran 1997) and this was not acceptable in traditional approaches. Autoregressive distributed lag approach to cointegration provide strong results and consistent estimate in case of small sample of long run coefficients as compare to other cointegarting approaches of traditional (Pesaran and Shin 1998; Haug 2002) .

Considering the above advantages of ARDL approach to cointegration, present study employed this approach considering assumptions of ARDL also. First of all this study checked level of integration of all projected variables, because of any variable $I(2)$ or above, ARDL approach is not applicable.

$$T_t = \varepsilon + \sum_{i=1}^n \alpha_i T_{t-i} + \mu_t$$

Where X_t and Y_t are included in vector T_t . Y_t represents the dependent variable CO2 emission and X_t represents a set of explanatory variables in model. Time is denoted by t .

Vector error correction model (VECM) is given as below

$$\Delta T_t = \varepsilon + \beta_t + \lambda T_{t-1} + \sum_{i=1}^{n-1} \gamma_{yt} \Delta y_{t-i} + \sum_{i=1}^{n-1} \gamma_{xt} \Delta x_{t-i} + \mu_t$$

The long-run multiplier matrix as:

$$\begin{bmatrix} \lambda_{yy} & \lambda_{yx} \\ \lambda_{xy} & \lambda_{xx} \end{bmatrix}$$

The sloping essentials of the matrix are limitless, so the selected series can be either I(0) or I(1).

If, $\lambda_{yy} = 0$ then, Y is I(1) and if, $\lambda_{yy} < 0$ then, Y is I(0).

3.5 Bound Test

This study conducted bound test to find out long run relationship as given in equation (3.1), using F-Statistics with the help of two bounds, i.e. lower bound and upper bound. To check cointegration among variables, null hypothesis assumes that no cointegration. It is concluded that if the F-Statistics values comes greater than the upper bound then null hypothesis is rejected if F-Statistics values comes lower than lower bounds we conclude no Cointegration. But if F-Statistics values fall between upper and lower bound the test is inconclusive Pesaran, Shin et al. (2001). As it already stated that present study use ARDL exploration, so the first step to define the presence of long run relationship between the variables. Pesaran and Shin (1999) there must be maximum two orders of lag use to estimate ARDL.

3.6 Optimal Lags

To choose optimal lags present study elect optimal lags on the base of (SIC) for all variables.

Model specification

To verify the findings of the previous studies, this equation is developed

$$CO_2 = \beta_0 + \beta_1 ENC + \beta_2 GDP + \beta_3 FDI + \beta_4 PG + \mu_i \text{ ----- (3.1)}$$

Whereas:

$\beta_1, \beta_2, \beta_3, \beta_4$ are the co-efficient

β_0 is intercept term

μ_i is disturbance term

- CO2 = Corbin dioxide emissions (per capita)
- ENC = Energy use (kg of oil per capita)
- GDP = Gross domestic product
- FDI = Foreign direct investment
- P.G = Population growth

An ARDL general equation:

$$\Delta(CO_2)_t = \gamma_0 + \sum_{i=1}^a \gamma_{1i} \Delta(CO_2)_{t-i} + \sum_{i=2}^b \gamma_{2i} \Delta(ENC)_{t-i} + \sum_{i=3}^c \gamma_{3i} \Delta(GDP)_{t-i} + \sum_{i=4}^d \gamma_{4i} \Delta(FDI)_{t-i} + \sum_{i=5}^e \gamma_{5i} \Delta(PG)_{t-i} + \gamma_6(CO_2)_{t-i} + \gamma_7(ENC)_{t-i} + \gamma_8(GDP)_{t-i} + \gamma_9(FDI)_{t-i} + \gamma_{10}(PG)_{t-i} \tag{3.2}$$

The intercept term is γ_0 while

$\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6, \gamma_7, \gamma_8, \gamma_9, \gamma_{10}$

are the coefficient of short run and long run.

Research Hypotheses

In order to answer the research questions and to achieve the objectives of this study, the following hypotheses are hereby state in the alternative form:-

Ha: There is a relationship between Co2 emissions and energy consumptions

Hb: There is a relationship between Co2 emissions and gross domestic product

Hc: There is a relationship between Co2 emissions and foreign direct investment

Hd: There is a relationship between Co2 emissions and population growth

4. Results and Discussion

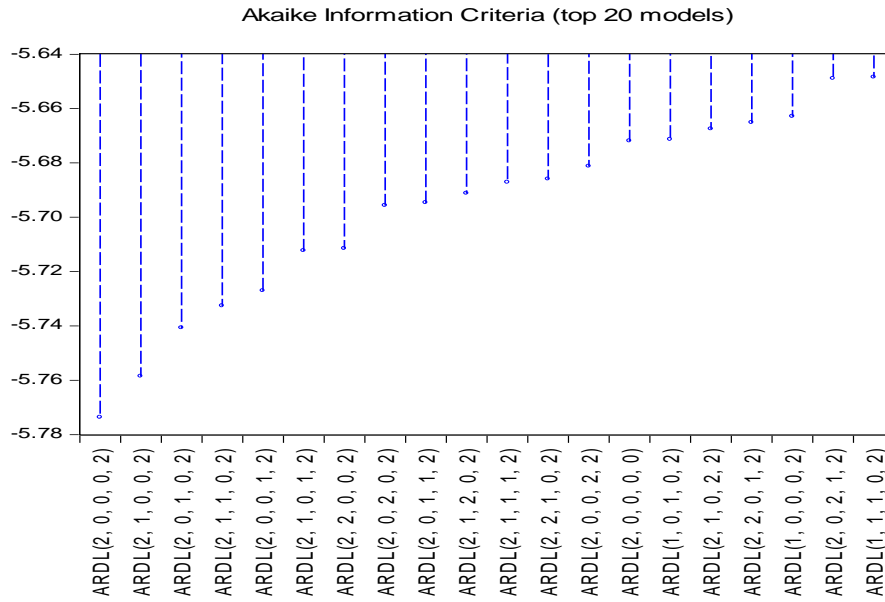
This study comprises of five variables Corbin dioxide as dependent variable, while energy consumption, gross domestic product, foreign direct investment and population growth as independent variables. Whereas, outcomes presented in the succeeding Section, unit root, ARDL Bounds Test, and ARDL approach, ECM and other diagnostic test.

Table 4.1 Unit root

At level			At first difference			Conclusion
Variables	T-Values	Probability	Variables	T-Values	Probability	
CO2	0.56666	.98	CO2	-6.044	0.00000	I(1)
ENC	-0.7409	.8246	ENC	-5.2940	0.0001	I(1)
GDP	3.2306	1.000	GDP	-3.4218	0.0159	I(1)
FDI	2.5238	0.9999	FDI	-5.4497	0.0001	I(1)
P.G	-3.3777	0.0563	P.G	-1.52789	0.8034	I(0)

Table 4.1 represents the result of unit root tests of all series used in the study. Unit root test is applied to check whether data is stationary or not. Stationary in data is very important, because if a trend exists in data, spurious results are produced which are very harmful. Hence, to avoid bogus results, the study has applied unit root tests. Table 4.1 is representing that unit root is checked at level and first difference. The output file of results indicates that all the variables are stationary at 1st difference, except one variable P.G which is stationary at level at 10% level of significance. So, the null hypothesis is rejected because there is no trend in analyzed data and the alternative hypothesis is accepted because the data is stationary. Now we can further move to explore the relationship between independent and dependent variables.

Table 4.2 Optimal lags



E-views9 output

Table 4.2 representing optimal lag lengths criteria we applied Akaike Information Criteria (AIC) to choose optimal lags of variables including in ARDL model, as above results are out of Eviews 9 and software automatically selected two lags for Corbin dioxide and population growth, while zero lag for energy consumption, gross domestic product and foreign direct investment.

Table 4.3 ARDL Bounds Test: To know about long run relation

F-statistics		8.16	
Critical value bounds			
Significance	I0 Bounds (lower bounds)	I1 Bounds (upper bounds)	
10%	2.45	3.52	
5%	2.86	4.01	
2.5%	3.25	4.49	
1%	3.74	5.06	

Author’s calculation on the base of (Pesaran, Shin et al. 2001)(E-views 9 Output)

Table4.3 demonstrating results of bounds test, if F-statistics value comes more than critical value of bounds, it indicate long run relationship among projected variables (Pesaran, Shin et al. 2001). As F-statistics value (8.16) is more than the upper bound of bounds value at 5%, which is suggesting that long run relationship exist between the variables. In a nutshell, proposed variables are Cointegrating and will move together in long run.

Table 4.4 Long-Run Coefficients of ARDL (1, 1, 0, 0, 1) Model Dependent Variable (CO2)

Variables	Coefficient	Std.Error	T.statistic	Prob.
Constant	-0.636458	0.120897	-5.264449	0.0000
ENC	0.002644	0.000199	13.230393	0.0000
GDP	0.000137	2.200886	6.255483	0.0003
FDI	0.010214	0.005386	1.8963	0.0664
P.G	0.0520766	0.0215	2.41686	0.021

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Table 4.4 Contains the results of long run relationship between variables mentioned in equation (3.1). Energy consumption is most significant factor of Corbin dioxide emissions in Pakistan. The effect of energy consumptions is significant at 5% level of significance. The coefficients value of ENC (0.002644) which is indicating that increase one unit in energy consumption leads to over 0.002644 units increase in Corbin dioxide emission in long run. Gross domestic product (GDP) is also another significant factor of Corbin dioxide emissions in Pakistan. The effect of GDP is also significant on Corbin dioxide emissions at 5% level of significance. The coefficient value of GDP (0.000137) is representing that increase 1 unit in GDP leads to over 0.000137 units increase in Corbin dioxide in long run. In addition FDI is of determinant of Co2 emissions which is positively and significantly associated with Co2 emissions at 10% level of significance. FDI coefficient value is 0.010214, which is showing that if we increase one unit in fid it drives positive response to co2 emissions in long run. Finally population growth is one of Co2 determent with highest coefficient value (0.0520766), which is revealing that if we increase one unit in P.G it will positive response to Co2 emissions in long run. Present study supports the finding of (Chen and Huang ; Shi 2001; Martínez-Zarzoso, Bengochea-Morancho et al. 2007; Soytaş, Sari et al. 2007; Zhu and Peng 2012; Blanco, Gonzalez et al. 2013; Omri 2013).

Table 4.5 Error Correction Representation of the Selected ARDL (1, 1, 0, 0, 1) Model Dependent Variable (CO2)

Regressor	Coefficient	Std.Error	T.statistic	Prob.
D(ENC)	0.001920	0.000174	11.018820	0.0000
D(GDP)	0.000100	0.00023	4.4019722	0.0001
D(FDI)	0.007417	0.00391114	1.89639	0.0664
D(P.G)	0.383123	0.1567937	2.4434902	0.019890
ECM(-1)	-0.6997	0.087184	-8.02628	0.0000

R²=0.46, F-statistics (prob) =5.39 (0.0002), D.W 1.597

Table 4.5 is representing results of Error Correction Representation of the Selected ARDL model. Coefficients with “D” sign signifying short run elasticities. Energy consumption once again in short runs with having most significant “P” value and greater “T” value as compare to other independent variable, effecting positively Corbin dioxide emissions. The coefficient value of D(ENC) (0.001920) expressing that if we increase one unit in D(ENC) it will bring positive 0.001920 units increase in Co2 emission in short run. While D(GDP) and D(P.G) also have positive and significant association with Co2 emission in short run and both of the variables will react with Co2 emissions with respect to their coefficients values in short run. However, D (FDI) is one of Co2 determinant which is significant at 10% level of significance with coefficient value 0.007417. The coefficient (-0.6997) of Error correction term (ECM (-1)) is significant at 5% level of significance. Negative and significant error correction term indicates speed of conversion, its mean in next year dependent variable come toward equilibrium with the speed or 67%.

Diagnostic Tests

Table 4.6 Breusch-Godfrey Serial Correlation LM Test:

F-statistics 0.1067	Prob. F(2,34)	0.8990
Obs*R-squared 0.2850	Prob. Chi-Square(2)	0.8671

Table 4.6 is showing results of serial correlation, serial correlation is a situation when error term depends on its previous time period error term. Serial correlation is most important diagnostic test

because of serial correlation exist when we neglect any relevant variable, serial correlation also provide information about Incorrect Functional Form (Gujarati: Basic Econometrics, Fourth Edition). Null hypothesis for serial correlation is no serial correlation between residuals. Meanwhile the P-value (0.8671) of Obs*R-squared is greater the 5%, hence on the base of observed p-value of Obs*R-squared we will accept null hypothesis.

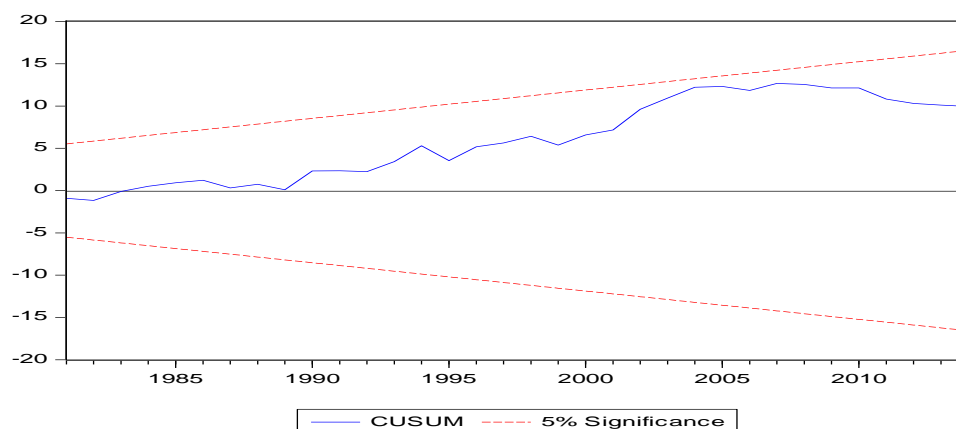
Table 4.7 Heteroskedasticity: Breusch-Pagan Godfrey Test:

F-statistics	1.0078	Prob. F(8,34)	0.8644
Obs*R-squared	8.2423	Prob. Chi-Square(8)	0.410

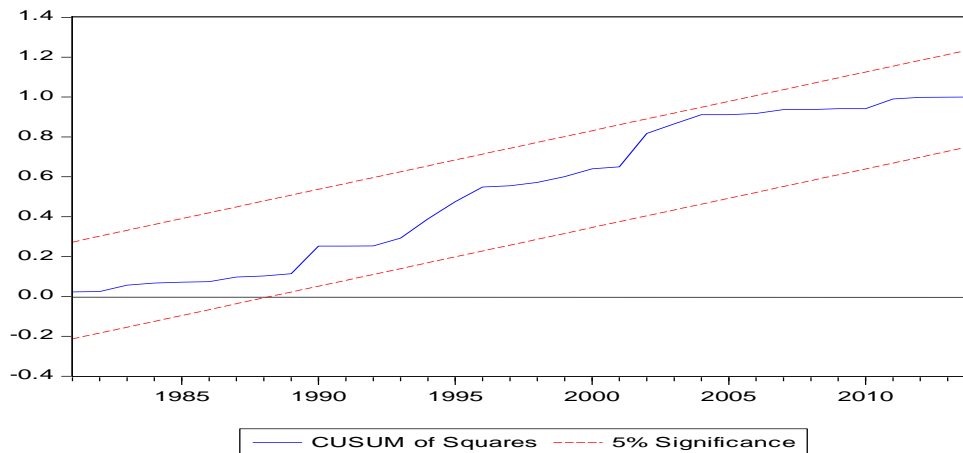
Table 4.7 displaying output of Heteroskedasticity, a situation when variance of residual doesn't remain constant, it is called Heteroskedasticity, which is not desirable, while if variance of residuals is constant it is called homoscedasticity, which is desirable. To check Heteroskedasticity is most important in time series data because of, by virtue of Heteroskedasticity existence standard error no more accurate and T-Statistics may be higher or lower. Null hypothesis is homoscedasticity or variance of residuals is constant. Meanwhile the P-value (0.6752) of Obs*R-squared is greater the 5%, hence on the base of observed p-value of Obs*R-squared we will accept null hypothesis.

Table 4.8 Cusum (Cumulative Sum of Recursive Residuals) Test.

Brown et al. (1975) introduced Cusum (cumulative sum) and Cusum of squares tests. Cusum test is based on a plot of the sum of recursive residual .Following charts are showing two straight red lines, while there is one blue line which is within these two lines, red lines are representing 5% critical bounds, where null hypothesis of having stable parameters' for each of projected variables is rejected if blue line cross redlines .On the other hand, if plot remain within two straight line null hypothesis is not rejected. Cumulative sum test helps to show if coefficients of regression are changing systematically, whereas cumulative sum of square test is helpful to showing if the coefficients of regression changing suddenly (Bhatti, Al-Shanfari et al. 2006) p.270).Hence on the base of following charts representation we can conclude that there is no structure break or simple we will conclude that parameters' are stable because blue line is existing within red straight lines ,hence we will accept null hypothesis of stable parameters.



CUSUMSQ (cumulative sum of squares) test



5. Conclusion

Environmental problems always gained attention of the peoples from all over the world, the major reason of sudden change in people's behavior is climate change, and in last few decades human activities are proved a main source of environment degradation, which is very harmful for the all living bodies. Due to certain advantages, discussed in chapter three , present study applied bound test based Cointegration technique, to test stability of parameters present study employed CUSUM and CUSUMQ , by employing annual time series data from 1970-2015S for exploring major determinants of Environmental degradation. Present study included four determinants were energy consumption, GDP, FDI and population growth.

Finding of the study presented a positive association among energy consumption, gross domestic products, population growth and environmental degradation in short run as well as in long run. However, foreign direct investment has a positive and significant association with environmental degradation at 10% level of significance in short-and long-run.

6. Limitation of the Present Study

There are few limitations of this study , like present study measure environmental degradation with only on indications (co2) ,and other limitation is that there are other macroeconomic variables which are also hurt environmental like fdi ,oil prices etc. Hence further student and researchers can add more explanatory variables and different proxies for environmental degradation.

7. Recommendations

The econometric findings suggest that Pakistan has to sacrifice use of energy consumption, to have a safe and healthy environment for better livings; Pakistan should adopt other way of energy like solar energy .While foreign direct investment must be used for pollution free machine or pollution free projects so that we can have clean Pakistan. Government of Pakistan should care about green policy and should spread awareness in public so that population growth should not be a problem of environmental degradation.

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