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THE IMPACT OF CARBON DIOXIDE & NITROUS OXIDE ON ECONOMIC GROWTH IN PAKISTAN, CO-INTEGRATION ANALYSIS

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ABSTRACT

The study explore the impact between economic growth and environment degradation and in Pakistan. CO_2 and N_2O have been used as the proxy of environmental degradation. The time series data has been taken over the period from 1972-2017. Johansen Co-integration estimation technique has used for estimation and the results from pairwise granger causality test shows GDP , CO_2, and N_2O do not have granger causality between them respectively. The generalized impulse response function (GIRFs) also applied to examine the dynamic effects of variables. The findings reveal from multi-variate co – integration analysis long run relationship exists among all variable in the study. The results of Generalized Impulse Reflection Function derived the dynamic effects with GDP and CO_2 and N_2O are positive and negative in responses time period.

Keywards: GDP,CO_2 , N_2O,DI,TO,ELF .

INTRODUCTION

According to Ravallion & Chen (2010), considerable changes in 'SI (social indicators) of development have been pragmatic over the last two eras. Report of human development indicated that numerous less developed countries have experienced positive change in their HDI (human development indicators). It is comprised of life expectancy, educational attainment and mortality rate, **united** nation development program, 2013. All developing countries augmented their accomplishments in the magnitudes of 'human development'. It was observed the slower improvement in countries having high (Human Development) and quicker growth in countries were observed those have been experiencing medium 'human development indicators'. Furthermore, it has been observed the decline ratio of community beneath the poverty line to 52 - 24 percent during the period between 1980 and 2008, 'HDR (United Nation Development Program, 2013). The combination of economic development, implication of better policies and by determining the 'millennium development goals' world has been experiencing extraordinary economic growth.

Tilly (2010) declared that the process of economic transformation started with the mid of eighteen centuries (1750), where the stress on industrialization taken the place of heavy dependence on agriculture sector of the economy and the uprising spread across 3-time eras. First period accorded as the era of early industrialization ranges from 1750 to 1870. The period was concerned with the obsessed of agrarian activities. Focus in this period was on the absorption of land and food production for existence purposes. For mechanical and transportation actions condensation and petroleum engine were powered in this era.

Second era covered the period from 1870 to 1914 accorded as era of rapid industrialization. Here the desire to get industrialized and urbanized had spread to other 'European economies'. The changes that attached with this era were the application of research and development and replacing the L-intensive techniques of production into k-intensive techniques. It was the desired that agriculture sector will improved within the discovery of oil and steel industries emergence. By application and following the comparative advantage theory of trade it was desired to raise the trade volume with rest of countries.

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The third era ranges from 1918 to onward late 20th century. The era accorded as the revaluation from industrialization. This era was Blemished with the two flaws that is the emergence of "two world wars and the great depression of (1929-1933)". But it did not hamper the goals of that era a lot. As the focus here is on the huge investment on social 'overhead capital (SOC)' that will have demanded the more 'directly productive activities (DPA)' that will in turn leads to economic growth. The fourth era of mechanization is on its prospect.

This study summarized the panel study of low, high and middle-income countries 213 and over period among 1970 and 2008, Aşıcı, (2013)- The complex system like nature's measuring impact has tough task, whereas. Evaluation and accumulation thus problems, persuade some scholars to overview on few directions; i.e. economic growth, pollution and deforestation. The scholars assured that at particular level of development (or income p.c.) is attained, by the economic vitality environment does not affect negatively. On contrary, rest of them admonished that the demand of human has earlier caused environmental degradation that negatively affected the Earth's ecological surface. In middle – income countries the ratio openness to trade enhanced to 54.3 in 1970 to about 100 in 2008. Summarized that, in low and middle-income countries, export ability of production goods and primary commodities generates more income. Moreover, environmental quality indicator used to account environmental degradation in the country of production instead of consumption.

To contrary, one of allies of the World Commission on Environment and Development's report 1987 shows the environment is probing for much of the evolution in developing countries. Developing countries emphasized at time preference, i.e., the future has less esteemed than the present. For extent, that effort to live alive in the present is more substantial to coming year's crop yield. Moreover, crumble moves on the environment generate assist today also worth in the future, the environment is frequently.

Financial development directly influences to energy consumption that creates CO2 emissions Sadorsky, 2010, Tamazian, Chousa, & Vadlamannati (2009). Borrowing cost can be reduced by rapid financial sector, raise asset for energy productive sector, others decreased omission energy emissions (Tamazian et al. 2009; Tamazian and Rao, 2010; Sadorsky,2010; Shahbaz, 2009; Shahbaz et al. 2010). In particular, least take cost to move environment favorable proposals give edge to national, regional and local governments. Jensen (1996) on contrary describes that industrial growth by financial development increases CO_2 emission. Muhammad Shahbaz et al., 2011.

Following the above purposes, following questions are framed. The general research questions are:

1) What is the relationship of Economic Growth and CO_2?
2) What is the relationship of Economic Growth and N_2O?
3) What is the impact of CO_2 emission on Economic growth?
4) What is the impact of N_2O emission on Economic growth?

Research Objective

General Objective

- To check the impact between Environment degradation and economic growth in Pakistan.

Specific Objective

The specified objectives of the study are:

- To check the long run impact of CO_2 emission on economic growth in Pakistan.
- To check the long run impact of N_2O emission on economic growth in Pakistan.

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LITERATURE REVIEW

This part is reserved for reviewing the related theoretical and empirical literature to the environmental degradation and growth association both at international and national level. The existing literature is mainly grounded on two opposing ideas; consequences of environmental Quality to economic growth and impact of economic growth and environmental quality.

Vujović, Petković, Pavlović, and Jović (2018) investigated that carbon dioxide emission (CO2) intensity and Economic development greatly influence by energy consumption. The more substitution, sustainable energy sources but CO2 emission concentration to more spring needs to be probelarge. The study based on CO2 emission concentration ground another, renewable energy, fossil as well. The economic growth ground to the CO2 emission concentration has investigated. Neuro-fuzzy methodology , selected the energy factor for economic growth and CO2 emission intensity. Conclusion has shown that CO2 emission intensity has greatly impacted by alternative energy. CO2 emissions intensity to solid fuel has highly impact on the economic growth.

Chen, Thapa and Yan (2018) determined aggressive to regional tourism for a low-carbon economy circumstance has critical issue to elaborate energy policies, also segregate national carbon discount. Study summarized that for Yangtze River Delta (YRD), China, and relation over tourism, economic growth and carbon dioxide (CO2) emissions perceived. The decoupling analysis, bottom-up approach and Logarithmic Mean Divisia Index (LMDI) breakdown were consolidated & enforced. Findings to 2001 -- 2015 shown the tourism-impel energy consumption & also CO2 emissions in YRD enhanced to 896.90 _ 108 MJ to 3207.40 _ 108 MJ, and 673.55 _ 104 t to 2152.27 _ 104 t, respectively. In Shanghai Tourism-kin transport was vital patron to emissions. Correlation over economic growth and CO2 emissions, on the whole, were exist to YRD's tourism, exclude to 2004. Even so, condition for Shanghai was perplexed. Furthermore, industry size, expense size accomplish were major part to boost carbon emissions growth, although energy intensity, extensional formation, & sectarian texture has opposing influences. Major problems for policy makers have been focus and discussed.

Zhang, Wang, Z., & Wang, B. (2018) explored that the Relations betwixt energy consumption and CO2 emission built into various variables. Though, position of energy production to the pollution equation generally anonymous. The study summarized relationship to CO2 emission, energy production and economic growth. Afamily of econometric tools used to execute. Unit root test is used evaluate firmness of parameters for time 1970–2011. Johansen cointegration test proves validity of cointegration to variables. Auto regressive distributive lag model affirm, energy production to the fossil fuel is foremost offender back end growing CO2 emission. Furthermore, summary declare validity of EKC hypothesis in consequence of energy production in Pakistan. Additionally, two-way causality is distinguished betwixt carbon dioxide emission and energy production in the long-run. Pollution can be reduced by building energy by the renewable source (hydropower and solar power, geothermal and wind energy) and subjoin further renewable energy to the energy merge.

Mardani, Streimikiene, Cavallaro, Loganathan and Khoshnoudi (2018), discussed economic growth and Carbon dioxide emissions a precise review for time 1995 -- 2017. The consequences present the nexus to CO_2 outflows and monetary development provides description afterward approach choices that need to lessen discharges by forcing restricting variables on financial development also. Given the way that bidirectional causality exists, the extent that financial development advancement or diminishes, further CO_2 discharges animated in higher or

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overturn dimensions and subsequently, a possible decrease for outflows ought to have antagonistic impact on monetary development.

Armeanu, Vintilă, Andrei, Gherghina, Drăgoi, and Teodor (2018). examined a panel EU-28 countries for 1990-2014 on hypothesis (EKC), seeming the primarily energy consumption along selected variables of other country . The conclusion shows the EKC hypothesis for sulfur oxides & of non-methane inconstant organic compounds has estimated. Findings from fixed - effects methods to Driscoll-Kraay standard errors support, EKC hypothesis for greenhouse gas, strain of energy consumption and nitrogen oxides, non-methane inconstant organic compounds and ammonia emissions.. GDP per capita growth to greenhouse gas emissions expose a short-run unidirectional causality by panel vector error correction model, In addition to two-way causal link among prime energy consumption and greenhouse gas emissions. Moreover economic growth and prime energy consumption have no casual link between them, the neo-classical point of view was proved, named the neutrality hypothesis.

Shahbaz, Nasreen, Ahmed and Hammoudeh (2017) determined over trade openness TO , CO2 emissions relationship consolidate economic growth like an excess and latent element to correlation for groups high, middle , low income economies counted as 105. Pedroni (1999) and Westerlund (2007), summarized the study, panel cointegration tests were implied, in three variable cointegration was exist. EQ obstructed by Trade openness to the world, high income, middle and low income panels but knock dissimilate the various economies. The panel vector error correction model causality findings focus a rebuttal affect to carbon emissions and trade openness to general stage and middle income economies also trade openness Granger causes CO_2 emissions to high income and low income economies. Policy accomplishment has granted too.

Aljawareen and Saddam (2017) explore the positive relationship to real GDP and carbon dioxide emission for all GCC countries. The data used for 1998 -2008 is used. In industrial sector for GCC countries increased the GDP will increased the level of carbon dioxide emission. As compared to GCC countries FDI inflows leads the increase of air pollution in Qatar, that do pollute the environment. Furthermore commodities imports leads to reducing level of carbon dioxide emission. Six GCC countries are used for the panel data technique by cross-section random effects.

Ghorashi and Rad (2017) explored the relationship among environmental quality, growth and health expenditure taking Iranian economy. Dynamic simultaneous equation models were applied to check relation for selected variables , time series data ranges. Results of the model pointed out the existence of positive two-way association betwixt EQ and economic growth. Carbon dioxide emission was taken proxy for measuring environmental degradation in Iran. One-way causality was noted betwixt human health and economic growth. This implied the Pre-environmental improved quality is necessity for economic growth. so, government should follow the policy of clean up now and grow later.

After collecting the data of carbon dioxide emission for forty countries including thirty-five industries for the period from 1995-2007, Mir and Storm (2016) analyzed the affiliation among environmental quality and economic growth. They adopted two-different perspective of carbon dioxide emission that is consumption and production based carbon emission to measure the environmental degradation in the selected regions. The results of the study indicated that by employing consumption based carbon dioxide emission (as proxy for EQ), EQ and economic growth hold considerable positive effect.

Ahmed, Shahbaz, Qasim, and Long (2015) explore either the (EKC) hypothesis exist in Pakistan for using time series data for 1980–2013. For environmental degradation deforestation

(dependent variable), economic growth, energy consumption, trade openness, and population were also investigated as independent variables. For estimation (ARDL) bounds testing approach to cointegration, also the VECM–Granger causality test used to estimation. The cointegration in long- & short-run exist. Whereas, declined the economic growth GDP on deforestation in the long-run has negative impact that prove the EKC hypothesis for deforestation in Pakistan. Furthermore, deforestation is Granger caused by economic growth GDP and energy consumption CO2. Economic growth GDP, energy consumption CO2 has bidirectional causal influence among them, furthermore, to long-run economic growth GDP and trade openness TO has Granger cause with energy consumption CO2. The several momentous tests applied to coated results to policy applied also to subsidize to future more viewed on the environment-growth-energy aspect.

Begum, Sohag, Abdullah, and Jaafar (2015), summarized the CO2, energy consumption economic growth GDP and population growth for Malaysia over 1970 - 2009. The conclusion more over shown both per capita vitality utilization , per capita GDP has long cart definite contacts to per capita carbon emanations, whereas, populance development rate has not worse effects on per capita CO_2 stream. However, the investigation proposes that over the long cart, monetary development may negative effect the CO_2 discharges in Malaysia. Consequently, critical change of low carbon origination, for instance, sustainable power source and vitality expertness could add to diminish the discharges and continue the long run monetary development.

By employing FMOLS, Cheema and Javaid (2015) determined the existence to long run affiliation to energy consumption, EQ and GDP in ADC (Asian Developing Countries). Relationship was observed by considering the financial development and globalization as control variables. The long run elasticity derived based on FMOLS showed that regardless of the form of energy consumption has considerable positive affiliation over energy consumption & economic growth. Results from FMOLS to check validation of EKC prescribed and ratify the justification of EKC in selected countries to hold. After conducting the cost and benefit analysis it was observed that renewable investment energy has positive impact on the economy, implied that as its effect on EQ is very low so, government should design the process of economic development through investing in renewable energy consumption.

Shahid and Maryam, (2014) explored affiliation among economic growth and EQ grounded on Pakistan economy for the period from 1972-2011. The purposes of the study were two-fold first to enquire the possible association among economic growth , environmental degradation and second task to check applicability to EKC. To estimate the relationship ARDL bound testing approach was used. It proved the applicability of inverted-U shaped EKC in Pakistan for period under consideration. It was implied that environmental quality has pre-condition for economic growth, as environmental policies have greater influence of economic situation of the country.

Akpan and Abang (2014) summarized the link among environmental quality and economic growth by using EKC hypothesis to familiar as economic growth alone could serve as a long-run solution to environmental damage. A panel of 47 countries to theperiod 1970 -2008 has taken by applying Random-effect estimation and two-stage least square, on conclusion await on a quadratic model can easily tempt researchers to established the existence of EKC. Somewhat, link among economic growth and environmental quality shown illustrated by an N-shaped curve. After summarized, rapid long-run growth will not be appropriate solution to environmental quality. A number of worthwhile policy menu and critical questions to guide selection of the best key points capable of bringing about a decline in environmental damage have been proposed.

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Aşıcı, (2013) tries to explain the relationship among the economic growth's Burden on nature to perspective of environmental sustainability. The whole energy, mineral, net forest defeciency and carbon dioxide ruin, all in US dollars. The data of 213 countries has been taken for the period of 1970 -2018 from World Bank data. Fixed-effects and its instrumental-variables (IV) regress methods are used to investigate results. The study of Cross-country analysis explains that apositive relationship exists to income and pressure on nature. Study shows not linar relationship much better for mid-income economies and to sinking elevated-income economies. Moreover Environmental Kuznets Curve hypothesis donot supports that devaluation in environmental decadences formerly a definite development hit.

Ahmed and Long (2012) used EKC to explore , alliance to CO2 emission, trade liberalization and population density, economic growth GDP, energy consumption CO2 in Pakistan. The data range is used to 1971 -2008. Cointegration analysis , (ARDL) bounds testing approach techniques are applied, Accordingly to results in long run and short run CO2 and Growth both are supported by EKC. Time series estimation is used. On other hand trade and environment shows positive relationship and population and environment shows negative relationship to them. Energy consumption and growth leads environmental pollution in Pakistan.

Saboori, Sulaiman, and Mohd (2012) determined along-run as causal relationship over (CO2) emissions and economic growth GDP for Malaysia to 1980 - 2009 data , ARDL approach methodology has used to test EKC. The vital finding simply the validity of long-run for per capita CO2 emissions, real per capita, Gross Domestic Product (GDP), whereas the CO2 emissions are as dependent- variable. An inverted- U shape relation among GDP and CO2 has proven in short & long-run, although EKC hypothesis has found. The pairwise Granger Causality test laid to (VECM) shown and destruction causality among economic grow and CO2 emissions in short-run where as cover-directional influence to economic growth GDP to CO2 emissions in long-run.

By employing the bound test cointegration technique for Pakistan, Shahbaz, Lean, & Shabbir (2012), tried to explored association among environmental degradation, globalization, electricity consumption , growth for 1971-2009. Energy consumption was taken as a measure of growth and to measure EQ carbon dioxide emission was utilized. VEC technique was applied to derive EKC shapes. The findings revealed significant and positive relationship to electricity consumption and environmental degradation has exists. Moreover, long run estimated proved the validity of EKC in Pakistan for selected period under consideration.

Shahbaz, Zeshan, and Afza (2012) explored pattern of kinship betwixt energy consumption, economic growth GDP and EQ and by taking to Pakistan economy. Cobb Douglas production function was constructed for Pakistan by used time series data to 1972-2011. To establish long run association among variables 'Gregory and Hansen' (ARDL) bound test approaches were used. While 'Clemenete-Montanes-Reyes' technique use to checked the selected variables. The outcomes of ARDL, bound test approach and Pairwise Granger causality test, reported positive association to energy consumption (renewable & non-renewable), growth of factor of production (labor & capital) and economic growth. Moreover, negative relationship observed to economic growth and EQ.

To check the EQ and growth relationship with different geographical location, Sharma (2011) selected the group of sixty-nine countries to establish the relationship between them. Panel cointegration test prescribed the existence of positive affiliation to Environmental Degradation and Energy consumption. This relationship was observed to hold just for high income countries. While no significant association were found among carbon dioxide emission and growth in lower income

countries. Study implied that geographical location plays a significant role for establishing the relationship among economic growth and EQ.

Ray, S and Ray, I (2011) summarized that India has lead to environment degradation by the accelerated population growth, expansion and augmentation of agriculture, abandoned growth of urbanization and industrialization and eradication of natural habitats. The study explore that the population changed and land, forest and water and energy resources are affected by this. Accelerated population growth is main indicator in reducing per capita agricultural land, forest and water resources. The findings declare results increasing population density and exceeding people under poverty line caused by high population growth ratio. All economy problems of environmental degradation, land degradation and soil erosion are provoked by population pressure, so stirring productive resources for dense population. India faces production and consumption of energy due to rising population growth. The environmental has also affected effects that water polluted; air contamination and global warming of growing burden attributed so consumption levels enhanced. The conclusion that policy rumination and assert possible consequence to natural resources.

Shahbaz, Islam, and Butt (2011) summarized the study of Pakistan to checked equilibrium of long run using variables as CO2 emissions, energy consumption, financial development, economic growth GDP, and population growth. ARDL bounds testing approach to co-integration has applied for data 1974-2009 time period. Long run relation has found in variables by estimation. Financial development increases then CO2 emissions degrade.CO2 emissions expand rapidly from the population growth , economic growth and energy consumption. Conclusions support validity of EKC to Pakistan. The findings suggest to build policy that improve the environment condition and the financial development may be placed.

Nasir and Rehman(2011), determined carbon emissions, foreign trade income, energy consumption relationship in Pakistan to 1972–2008. For estimation Johansen method of cointegration has used, carbon emissions and income has long run relation between them, and Environmental Kuznets Curve for Pakistan has existed. Whereas, foreign trade and energy consumption be cause to increase emissions. The EKC has not existed in short run. The compatible outcomes for short and long-run leads policy makers to draft various kinds of growth policies as viewed environmental issues into deliberation. Furthermore, growth to energy consumption has one- way causality that advocated the policy makers has not only emphasized on forecasting future demand to energy with divergent growth scheme for least cost energy. In addition, Pakistan restrained its carbon emissions without troubling its economic growth to recommendation not causality for emissions.

By applying the Granger causality (GC) test Hossain, (2011) established the relationship to environmental quality (EQ), urbanization, globalization, energy consumption, economic growth by considering panel of NIC (Newly Industrialize Countries). Study was based on time series analysis to 1971-2007. To set order of the selected variables four panel unit root test were applied. The findings confirmed variable have not fulfilled the conditions of stationarity at their level (I (0), but they proved the conditions of stationarity after taking their first difference (I (1). ‘’The results of GC test prescribed that neither unidirectional nor bidirectional association exist to the scrutinized variables to long run. It was observed that unidirectional relationship exists to growth rate of GDP, EQ, energy consumption, urbanization and trade openness. Moreover, check strength of association in long run elasticity approach were used whose results confirmed that positive association exist to economic growth and environmental degradation through energy consumption.

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But the EQ proved to be good or constant while measuring the long run association to EQ and economic growth through the effect of globalization.

Boopen and Vinesh (2011) explore the relationship among GDP and CO2 to Mauritius and vice-versa in a ancient vista. By estimating the data for period from 1975 – 2009 time series and econometric methods are used. The estimation did not support the EKC for this period. The degradation alliance to GDP increased with time that intimates the economic and mortal happenings are continuously negative environmental impacts for country as to their economic welfare.

NiÅ, Lu, Lan, Gao, and Pan (2010) explored the link among EQ & economic growth in Shanghai derived shapes of the (EKC). He used panel data for 1989-2004. The income level of the country is very high that's changed the local environment of Shanghai. Environmental indicators are used i.e. drift in air nature, near-shore water in quality & surface water in quality to Shanghai and per capita of GDP has used to economical indicators. Four economy-environment relations studied for Shanghai over time taken. Indicator Surface water sustains EKC better as compare to ambient air and near-shore water indicator coated this finding by him.

By applying the vector error correction, panel cointegration & GC (Granger Causality) test for BRICS countries Pao &Tsai (2010) found the evidence of possible affiliation to carbon dioxide emission, output and energy consumption. The study covers period for selected group of countries from 1971-2005. Results of GC, VECT confirmed availability of bidirectional relationship to the selected variables in the selected group except Russia.

Jalil and Mahmud (2009) explored to energy consumption, income and foreign trade and carbon emissions long run relationship for China to 1975–2005 used time series data by using ARDL approach methodology. Although the study's ambition to check the influence validity for (EKC) relationship to CO2 and per capita real GDP. CO2 emission and Income has a quadratic relationship for this period and EKC relationship exists. The conclusions of Granger causality tests provide one way occurrence loop over economic growth to emission CO2. That findings suggested carbon emissions primarily purposeful from energy consumption & income in long run. CO2 emissions has positively and insignificant impacted by trade.

MODEL, DATA AND METHODOLOGY

This chapter presents the model specification and variables description. A wide range of studies have been conducted to establish and quantify the relationship to environment degradation and economic growth in Pakistan. This study is based on secondary data based and collected from World Bank.

The following are estimated variables and their impact on model explained:

Model:

$$\mathbf{GDP = \alpha_O+\alpha_1 CO_2 + \alpha_2 N_2O+\alpha_3 DI+\alpha_4 TO+ \alpha_5 ELF+ \varepsilon_O}$$

Where:

GDP= Gross Domestic Production

CO_2 = Carbon Dioxide emission

N_2O = Nitrous Dioxide emission

DI = Domestic Investment (Gross fix capital formation)

TO = Trade Openness (Exports of good and services)

ELF = Employed Labor force

ε_O = Error Term

Taking the log of both sides,

$$\ln GDP = \alpha_O+\alpha_1 \ln CO_2 + \alpha_2 \ln N_2O+\alpha_3 \ln DI+\alpha_4 \ln TO+ \alpha_5 \ln ELF+ \varepsilon_O$$

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Sources of Data and Description of Variables

This section briefly explains all dependent and independent variables. It utilized to establish and quantify the relationship among environmental quality and economic growth in Pakistan. The information on various variables from 1972 to 2017 is drawn from World Bank. The summary of variables described current study is given in the table 3.1 along with their definition and source of data is given below:

Data and description of variables

Variables	Nature of variables	Description	Definition
GDP	Dependent	Gross Domestic Product	GDP in million rupees in market prices has used proxy to Economic growth.
DI	Independent	Domestic Investment	‘’Gross fixed capital formation (aforetime gross domestic investment) consists of amount on accession to the fixed assets of the economy + net changes for level of inventories. ‘’
TO	Independent	Trade Openness	‘’Exports of goods and services represent the value of all goods and other market services provided to rest of the world. ‘’
CO_2 – emission	Independent	CO_2 Emissions	‘’Carbon dioxide emissions produced from manufacturing of cement by burning of fossil fuel.’’ Included that carbon dioxide also produced during consumption of solid, liquid , gas fuels and gas flaring.’’
N_2O	Independent	Nitrous Oxide	Nitrous oxide(N_2O) emissions are eject from burning of agricultural biomass, industrial activities, and livestock management. It is colorless gas.
ELF	Independent	Employed Labor Force	The labor force , or currently active population , comprises all persons, who fulfill the requirements for inclusion among the employed.

Data Analysis Methodology

Now seems to determination of data finalized its employed model.

Results and discussions

The Co-integration estimation technique has used for estimation for results. The mention tests have used for estimation resuts, descriptive statistics , Unit Root test, Co- integration analysis, Trace

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Statistics, Max – Eigen Statistic, Bi – Variate , Co – integration, Generalized Impulse Response function (GIRFs).

Descriptive Analysis

Descriptive statistic is used to analyze trends and relationship among dependent and independent variables. That provides average tendencies, distribution of data that helps to expand the span of research that gives better forecasting of future behavior. Forecasted results are useful aid for further analysis and policy implications.

Table: 1 Descriptive Statistics

	GDP	CO_2	N_2O	TO	DI	ELF
Mean	88053.45	0.667693	22702.17	11316.74	13416.59	36.62163
Median	56265.4	0.698088	23453.21	9059.233	9341.199	31.74
Maximum	304951.8	0.99103	30651.23	30699.24	44200.83	61.71
Minimum	6324.884	0.308601	13590.4	855.5562	723.2574	19.24
Std. Dev.	83537.55	0.22295	5041.005	9434.698	11676.98	12.84209
Skewness	1.192069	-0.1806	-0.1304	0.75224	1.046079	0.489184
Kurtosis	3.176876	1.661098	1.80236	2.259175	2.927398	1.869915
Jarque-Bera	10.95451	3.685974	2.879522	5.3902	8.399593	4.282401
Probability	0.004181	0.158344	0.236984	0.067536	0.014999	0.117514
Sum	4050459	30.71387	1044300	520570.1	617163.4	1684.595
Sum Sq. Dev.	314000000000	2.2368	1140000000	4010000000	6140000000	7421.364
Observations	46	46	46	46	46	46

Source: Software E-Views 9.0

Gross Domestic Product (GDP) is dependent variable but the Carbon dioxide (CO_2), Nitrogen dioxide (N_2O), Trade Openness (TO), Domestic Investment (DI) and Employed Labor Force (ELF) are independent variables used in the model of the study. The study used the 46 observations for the period of 1972 to 2017. The results of study revealed in the above table that center value of the data is mean and midpoint of data is measured by the median. Both mean and median both measured the central tendency of data. Value of mean of Gross Domestic Product (GDP) is 88053.45, median value of it is 56265.4, maximum value is 304951.8 and minimum value is 6324.884. The standard deviation shows the distribution of used data although higher standard deviation value indicated a larger spread. Value of standard deviation of Gross Domestic Product (GDP) is 83537.55. Skewness value of data presented the Symmetrical data trend in the descriptive statistics. Value of Skewness of Gross Domestic Product (GDP) is 1.192069 that showed positively skewed data of GDP. The standard value of Kurtosis is 3.The value of the Kurtosis of Gross Domestic Product (GDP) is more than 3 which shows that data has the leptokurtic distribution. While the values of Kurtosis of Carbon dioxide (CO_2), Nitrogen dioxide (N_2O), Trade Openness (TO), Domestic Investment (DI) and Employed Labor Force (ELF) are less than 3 that show data has Platykurtic distribution. The Jarque-Bera test is employed to test the goodness of fit variables. Jarque-Bera test for gross domestic product (GDP) has 10.95451 values which is more than 0.5 and estimate that data is not normally distributed. Probability (P) value of gross domestic product (GDP) is 0.004181 indicates that it is statistically significant because it is less than 5%.

Second variable of the model is Carbon dioxide (CO_2). Value of mean of Carbon dioxide (CO_2) is 0.667693, median value of it is 0.698088, maximum value is 0.99103 and minimum value is 0.308601. Value of standard deviation of Carbon dioxide (CO_2) is 0.22295. Value of Skewness of

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Carbon dioxide (CO_2) is -0.1806 show the data of this variable is negatively skewed. The value of the Kurtosis of Carbon dioxide (CO_2) is 1.661098 which is less than 3, shows that data has the Platykurtic distribution. The value of Jarque-Bera is 3.685974. The p. value is 0.158344 and this value of Carbon dioxide (CO_2) shows that it is statistically insignificant.

Third variable of the model is Nitrous oxide (N_2O).Value of mean of Nitrogen dioxide (N_2O) is 22702.17, median value of it is 23453.21, maximum value is 30651.23 and minimum value is 13590.4. Value of standard deviation of Nitrogen dioxide (NO_2) is 5041.005. Value of Skewness of Nitrous oxide (N_2O) is -0.1304 show the data of this variable is negatively skewed. The value of the Kurtosis of Nitrous oxide (N_2O) is 1.80236 which is less than 3, shows that data has the Platykurtic distribution. The value of Jarque-Bera is 2.879522. The p. value is 0.236984 and this value of Nitrous oxide (N_2O) shows that it is statistically insignificant.

Fourth variable of the model is Trade Openness (TO). Value of mean of Trade Openness (TO) is 11316.74, median value of it is 9059.233, maximum value is 30699.24 and minimum value is 855.5562. Value of standard deviation of Trade Openness (TO) is 9434.698. Value of Skewness of Trade Openness (TO) is 0.75224 show the data of this variable is positively skewed. The value of the Kurtosis of Trade Openness (TO) is 2.259175 which is less than 3, shows that data has the Platykurtic distribution. The value of Jarque-Bera is 5.3902. The p. value is 0.067536 and this value of Trade Openness (TO) shows that it is statistically insignificant.

Fifth variable of the model is Domestic Investment (DI). Value of mean of Domestic Investment (DI) is 13416.59, median value of it is 9341.199, maximum value is 44200.83 and minimum value is 723.2574. Value of standard deviation of Domestic Investment (DI) is 11676.98. Value of Skewness of Domestic Investment (DI) is 1.046079 show the data of this variable is positively skewed. The value of the Kurtosis of Domestic Investment (DI) is 2.927398 which is less than 3, shows that data has the Platykurtic distribution. The value of Jarque-Bera is 8.399593. The p. value is 0.014999 and this value of Domestic Investment (DI) shows that it is statistically significant.

Sixth variable of the model is Domestic Investment (DI). Value of mean of Employed Labor Force (ELF) is 36.62163, median value of it is 31.74, maximum value is 61.71 and minimum value is 19.24. Value of standard deviation of Employed Labor Force (ELF) is 12.84209. Value of Skewness of Employed Labor Force (ELF) is 0.489184 show the data of this variable is positively skewed. The value of the Kurtosis of Employed Labor Force (ELF) is 1.869915 which is less than 3, shows that data has the Platykurtic distribution. The value of Jarque-Bera is 4.282401. The p. value is 0.117514 and this value of Employed Labor Force (ELF) shows that it is statistically insignificant.

Table: 2 Unit Root Test

	ADF at Level		ADF at First Difference	
Variables	t-Statistic	Probability	t-Statistic	Probability
GDP	-2.246565	0.4533	-9.34053	0.0000
CO^2	-0.113945	0.9931	-8.01043	0.0000
N_2O	-2.302167	0.4242	-5.42539	0.0003
TO	-1.233073	0.8912	-7.75918	0.0000

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DI	2.329541	0.4101	-7.46736	0.0000
ELF	-1.72426	0.7239	-5.39563	0.0003

Source: Software E-Views 9.0

Results of table 2 indicate that all the employed variables are stationary at the first difference by using the Augmented Dickey Fuller (ADF) test.

Co-Integration Analysis

Co-integration analysis is essentially multivariate, because it is not feasible to co-integrate a single time series afterwards, assume a series of interconnected variables. However, direction of the causality is indicated by the co-integration (Hendry and Juselius, 2001).

Table: 3 Trace Statistics

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.687527	137.99	95.75366	0.0000
At most 1 *	0.579964	86.80759	69.81889	0.0012
At most 2 *	0.460587	48.64136	47.85613	0.0421
At most 3	0.28967	21.48131	29.79707	0.3283
At most 4	0.130332	6.432162	15.49471	0.6444
At most 5	0.00652	0.287837	3.841466	0.5916

Source: Software E-Views 9.0

Table: 4 Max-Eigen Statistic

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.687527	51.18242	40.07757	0.0019
At most 1 *	0.579964	38.16623	33.87687	0.0144
At most 2	0.460587	27.16005	27.58434	0.0566
At most 3	0.28967	15.04915	21.13162	0.2855
At most 4	0.130332	6.144325	14.2646	0.5948
At most 5	0.00652	0.287837	3.841466	0.5916

Source: Software E-Views 9.0

The result for multivariate co-integration analysis for all the sequences are presented in Tables 3 and 4. The results of present study depict that a long run relationship among Gross Domestic Product (GDP), Carbon dioxide (CO_2), Nitrous oxide (N_2O), Trade Openness (TO), Domestic Investment (DI) and Employed Labor Force (ELF) can be seen. According to the result linear combination of all these series shows long run relationship.

Table: 5 Bi-Variate Co-Integration

Variables	Eigenvalue	Trace Statistic	0.05 Critical Value	
GDP CO2	0.244722	12.37665	15.49471	No Co-Integration

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	0.000618	0.027195	3.841466	
GDP				No Co-
N2O	0.175176	12.24518	15.49471	Integration
	0.082144	3.771436	3.841466	
				No Co-
GDP TO	0.185191	9.386345	15.49471	Integration
	0.008488	0.375077	3.841466	
GDP DI	0.517905	33.24439	15.49471	Co-Integration
	0.025608	1.141415	3.841466	
GDP ELF	0.494632	30.18679	15.49471	Co-Integration
	0.003588	0.158153	3.841466	
CO2				
N2O	0.215406	16.21304	15.49471	Co-Integration
	0.118287	5.539113	3.841466	
CO2 TO	0.251957	15.97879	15.49471	Co-Integration
	0.070268	3.205796	3.841466	
CO2 DI	0.311511	19.80165	15.49471	Co-Integration
	0.073907	3.37837	3.841466	
				No Co-
CO2 ELF	0.165096	8.462056	15.49471	Integration
	0.011811	0.522769	3.841466	
N2O TO	0.211715	17.76385	15.49471	Co-Integration
	0.152808	7.296438	3.841466	
N2O DI	0.213967	17.86344	15.49471	Co-Integration
	0.152302	7.270169	3.841466	
				No Co-
N2O ELF	0.204495	10.44686	15.49471	Integration
	0.008613	0.380623	3.841466	
TO DI	0.352213	27.9855	15.49471	Co-Integration
	0.182775	8.880983	3.841466	
				No Co-
TO ELF	0.241557	12.44108	15.49471	Integration
	0.006244	0.275597	3.841466	
DI ELF	0.559279	36.12318	15.49471	Co-Integration
	0.001638	0.072111	3.841466	

Source: Software E-Views 9.0

Table 5 shows the findings of the bi-variate co-integration among the Gross Domestic Product (GDP), Carbon dioxide (CO_2), Nitrous oxide (N_2O) , Trade Openness (TO), Domestic Investment (DI) and Employed Labor Force (ELF). Gross Domestic Product (GDP) has bi-variate association with Domestic Investment (DI) and Employed Labor Force (ELF) in the long run. But Gross Domestic Product (GDP) has not bi-variate associated with Carbon dioxide (CO_2), Nitrous oxide (N_2O) and Trade Openness (TO) in the long run. Carbon dioxide (CO_2) has bi-variate long run association with Nitrous oxide (N_2O) , Trade Openness (TO) and Domestic Investment (DI) while has no cointegrated with Employed Labor Force (ELF). Similarly, Nitrous oxide (N_2O) has bi-variate long run association with Trade Openness (TO) and Domestic Investment (DI) while has no cointegrated with Employed Labor Force (ELF). Likewise, Trade Openness (TO) has bi-variate

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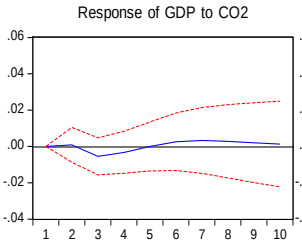
long run association with Domestic Investment (DI) while has no cointegrated with Employed Labor Force (ELF). Moreover. Domestic Investment (DI) has bi-variate long run association with Employed Labor Force (ELF).

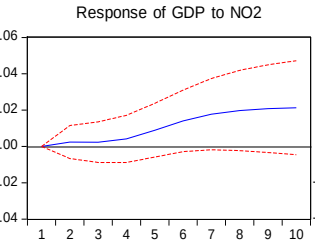
Generalized Impulse Response Functions (GIRFs)

As the model got the impulse, then the dynamic effects of the system are examined by employing the impulse response function. Model of the study has six variables. We design the graph to display the response function of all variables below:

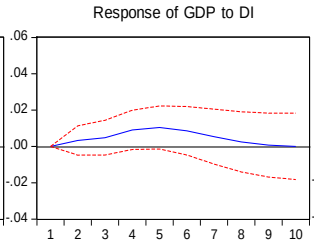
Graph:1



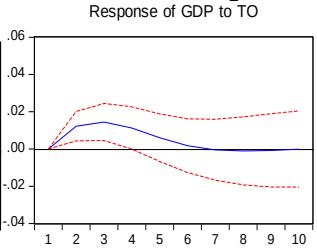
Graph:2



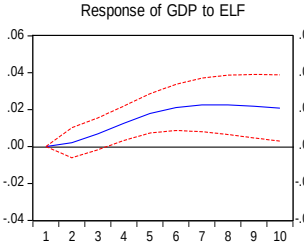
Graph:3



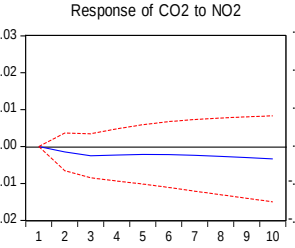
Graph:4



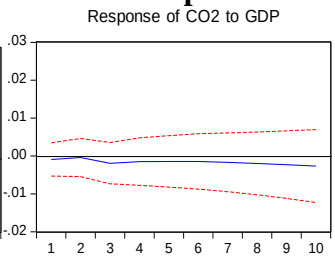
Graph:5



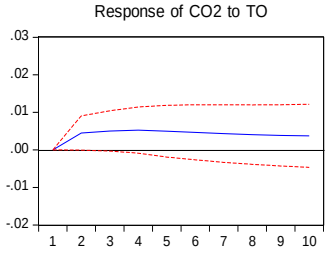
Graph:6



Graph:7



Graph:8

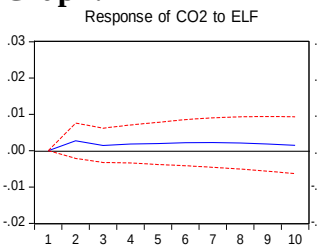


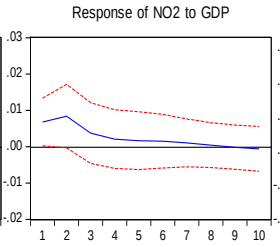
Graph: 9

Graph: 10

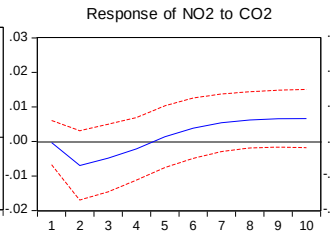
Graph:11

Graph:12

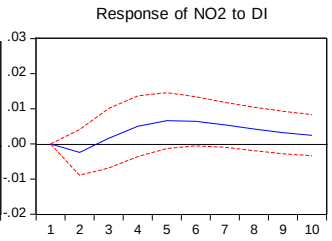




Graph:13

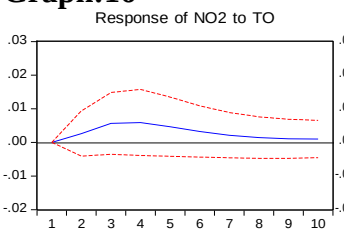


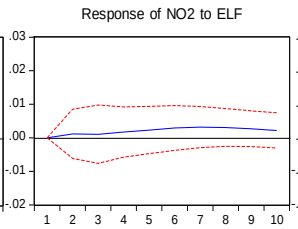
Graph:14



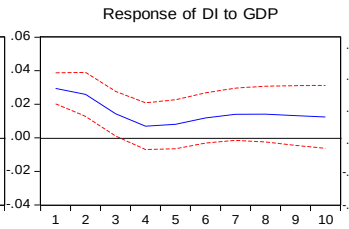
Graph:15

Graph:16

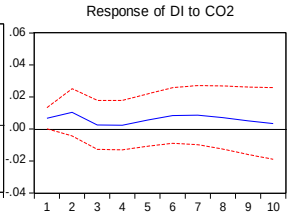




Graph:17



Graph:18



Graph:19

Graph:20

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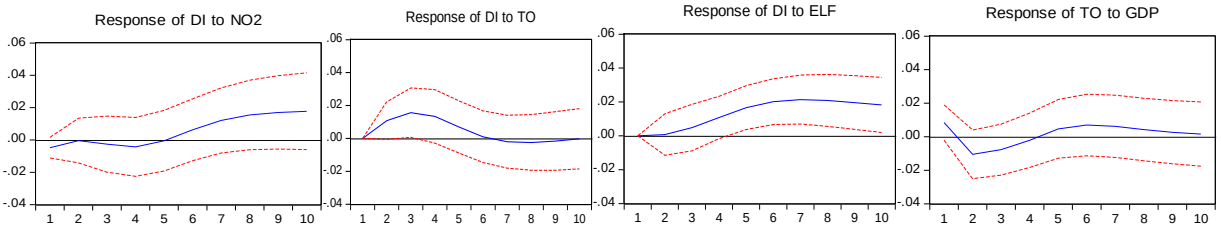
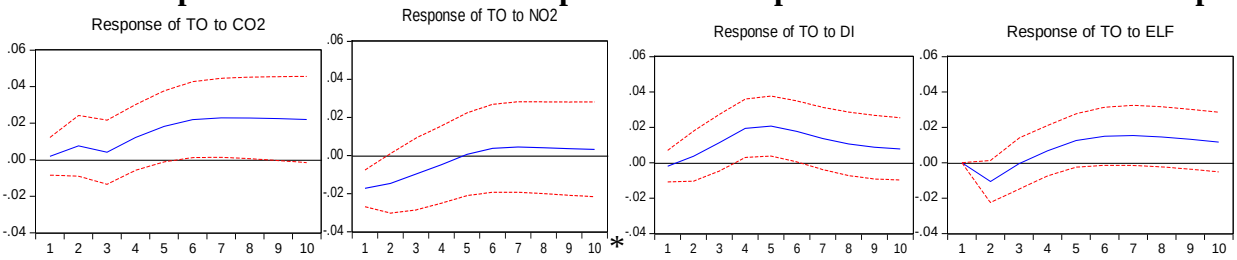
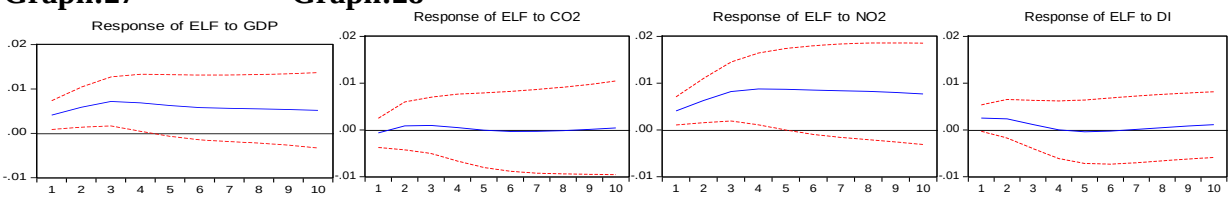


Graph:21 **Graph:22** **Graph:23** **Graph:24**

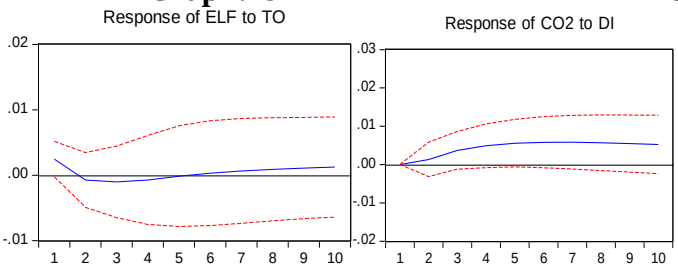


Graph:25 **Graph:26**

Graph:27 **Graph:28**



Graph:29 **Graph:30**



Above graphs show that When the impulse is Gross Domestic Product (GDP), responses of the Carbon Dioxide (CO_2) and Trade Openness (TO) are both positive and negative in the responsive time period. While responses of Nitrous oxide (N_2O), Domestic Investment (DI) and Employed Labor Force (ELF), positive all the time in responsive time period.

When the impulse is Carbon dioxide (CO_2), responses of Trade Openness (TO), Domestic Investment (DI) and Employed Labor Force (ELF) are positive in the responsive time period. While responses of the Gross Domestic Product (GDP) and Nitrous oxide (N_2O) negative all the time in responsive time period.

When the impulse is Nitrous oxide (N_2O), responses of the Gross Domestic Product (GDP), Carbon Dioxide (CO_2) and Domestic Investment (DI) are both positive and negative in the responsive time period. While responses of the Trade Openness (TO) and Employed Labor Force (ELF) is positive all time in responsive time period.

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When the impulse is Domestic Investment (DI), responses of the Nitrous oxide (N_2O) and Trade Openness (TO) are both positive and negative in the responsive time period. While responses of the Gross Domestic Product (GDP), Carbon Dioxide (CO_2) and Employed Labor Force (ELF) positive all the time in responsive time period.

When the impulse is Trade Openness (TO), responses of the Gross Domestic Product (GDP), Nitrous oxide (N_2O) Domestic Investment (DI) and Employed Labor Force (ELF) are both positive and negative in the responsive time period. While response of the Carbon dioxide (CO_2) positive in the responsive time period.

When the impulse is Employed Labor Force (ELF), responses of the Carbon dioxide (CO_2), Domestic Investment (DI) and Trade Openness (TO) are both positive and negative in the responsive time period. While response of the Gross Domestic Product (GDP) and Nitrous oxide (N_2O) ,positive in the responsive time period.

5.1 Conclusion

The conclusion of presented study concluded results from multi – variate co-integration analysis that long run relationship shown among all the variables of the study (GDP, CO, N2O, TO, DI, ELF). The results from bi-variate co-integration analysis reveal that no co-integration found between GDP, CO2 and N2O respectively. GDP, DI, ELF shows bi – variate association in long run among them , while CO2 has bi- variate association with N2O and TO. The results from pairwise granger causality test shows CO2, GDP and N2O do not have granger causality between them respectively. That means increase in CO2 does cause to increase GDP and vise versa. Ameyaw, B., & Yao, L. (2018) also supports this study that CO2 and GDP have bidirectional causality between them, as the CO_2 increased then the GDP also increased and wise versa. The impulse response function shows the results that we taking is impulse GDP the CO2 , Trade Openess show positive (Aye, G. C., & Edoja, P. E. (2017) also supports the results that the GDP increased then CO2 and Trade openness also increased and when GDP decreased then CO2 and Trade openness also decreased and they shows negative response and N2O, DI, ELF show positive response respective time. While taking is impulse CO2 then TO, DI, ELF show positive response in respective time while GDP and N2O show negative response in respective time (Wang, Z. X., Hao, P., & Yao, P. Y. (2017). Then the taking is impulse N20 GDP, CO2 and DI show both positive and negative response in respective time while TO an ELF show positive response in respective time. Nasir and Rehman (2011) supports that Carbon emission and income has unidirectional relationship in short run relationship while GDP and CO_2 have positive bidirectional relationship to each other respectively in long run relationship Shahbaz, Islam and Butt (2011) also supports conclusion of the study that long run financial acceleration will reduce the CO_2 emission. The CO_2 Emission increases which caused the environment degradation in Pakistan. In developing countries the environment kuznets curve theory supports but in this analysis in case study of Pakistan from the period of 1972-2017 by impulse response function the GDP increased but the environment is degrade as well, to improve our environment we should have to use better advanced technology for GDP generate.

Policy Recommendations

Government may have to make some environmental emission control policies. Although by the increase of GDP the environmental degradation need to be controlled.

At industrial level for production/GDP advanced technology need to be used that cause low environmental degradation and to promote our trade openness.

The government may make some policies for forest department to make the country green and new tree must be planted for compete with environment degradation.

Research for future:

Following is the agenda for future research;

1. The current study focused on, to check relationship of environmental quality and economic growth in Pakistan for 1972-2017. Other study can increase the time span for the investigation to explore this relationship among variables.
2. The current study used time series data and co-integration technique is used for findings results. Other research can be done by other estimation technique.
3. The further research can be focused on environmental kuzent curve theory and their kuzent curve shapes derived in Pakistan taken these variables.
4. The current study use time series data of one country Pakistan while the further study can employ the penal data for the same research and investigate relationship among the variables.

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