RELATIONSHIP BETWEEN ECONOMIC GROWTH AND ENVIRONMENTAL DEGRADATION IN PAKISTAN

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ABSTRACT- *The objective of this research paper is to study the relationship between Economic growth and Environmental degradation in Pakistan. For this purpose, we used secondary data for the period of 1984-2015 collected from different sources.Carbon Dioxide (CO_2) was taken as dependent variable while agriculture growth rate, education expenditure, health expenditure, household consumption expenditure and inflation were taken as independent variables. Auto Regressive Distributed Lag (ARDL) model, ADF's Unit Root test, Error correction model and Bound test were applied to study the short-run and long-run relationship between selected variables. Our study found that Agriculture growth, education expenditure and inflation rate have positive relationship with environmental degradation while health expenditure and household consumption expenditure have negative relationship with dependent variable.*

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1.INTRODUCTION:

1.1. Background of study:

Environmental degradation is an international issue and all countries of the world are struggling hard to resolve it. The developed countries have been able to control this problem to much an extent by introducing strict environmental laws and environmentally friendly technology. But the developing countries have so far failed to check environmental degradation due to rising population, use of coal, lack of solid waste management technology, high defense expenditures, ethnic unrest and rising poverty. According to UNICEF Report, 2016, around 14 percent population in South Asia are living below poverty line and are deprived of basic amenities. About 1.1 billion children live in extreme poverty all over the world.

Pakistan is among the countries where the rate of environmental degradation is very fast and natural resources are reducing rapidly while contamination in water and soil is increasing. According to Financial Survey of Pakistan, 2013-14, high population growth rate is increasing severe pressure on environmental resources. The environmental degradation is causing deficiency in the country. According to some estimate, Pakistan's economy is suffering a loss of Rs.365 billion (around US$2.35 billion) every year. This comprises inadequate water supply, soil degradation, lead exposure, indoor and urban air pollution, deforestation, lack of sanitation.

1.2 Environmental degradation:

Anderson, (1989) defines environmental degradation as *"Environmental degradation is the weakening of the surroundings due to the tiredness of capitals such as water, air and soil; the destruction of bionetworks*

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and the destruction of wildlife. It is labeled as any trouble in the environment
professed as undesirable".

1.3 Types of environmental degradation:

There are many types of the environment degradation such as

- Water degradation
- Climate change and temperature
- Population growth
- Climate change and precipitation
- Agriculture
- Water management

1.4 Main Research Problem:

The main research problem is to analyze the "Relationship between Economic growth and Environmental degradation in Pakistan."

1.5 Objective of the Study:

The objectives of study are outlined as follows: -

1. To investigate the causes of environmental degradation in Pakistan.

2. To study relationship between economic growth and environmental degradation.

3. To analyze the effects of environmental degradation on the economy of Pakistan

4. To study the problems produced as a result of environmental degradation.

5. To make recommendations how to control environmental degradation through policy initiatives.

1.6 Significance of Study:

This research work is very important because environmental degradation is one of the main problems of Pakistan. The results of this study will be helpful for policy makers to devise the polices to reduce environmental

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degradation and environmental pollution. Although our results are restricted to Pakistan, they can be generalized to other Asian countries which are facing problem of environmental degradation. This study will definitely help new researchers to conduct research on the basis of the findings of this study.

2. LITERATURE REVIEW:

We reviewed previous studies relating to environmental degradation and their results are discussed briefly in the following: -

Hussain and Anjum (2014) analyzed relationship between environmental degradation and level of poverty by using data from 1975 to 2009. They emphasized that natural resources must be used in a way that it enhances agriculture production, reduce emission and lessen level of poverty in Pakistan.

(Shahbaz, Solarin, Mahmood, & Arouri, 2013) examined relationship between CO_2 emission, manufacturing and population growth in South Asian countries, using data of 1980-2008. countries. They concluded that population growth rate and expansion of polluting industries are the main cause of environmental degradation and rising CO_2 level.

Awan (2015) has studied relationship between environment and sustainable economic development. He studied the condition of solid waste management, water contamination, air pollution, growing number of vehicles and scaling down of ground water level and falling crop yield due to environmental degradation. He concluded that sustainable development is not possible in existence of excessive use of natural resources.

Siddiqui (2010) examined the impact of defense expenses on development, inflation, service sector, using data of 1972-2009. He concluded that defense expenditures and high inflation increased poverty both in short

run and long run while growth of service sector had positive impact on poverty and industrialization.

Cavendish (1999) attempted to explore the poverty, inequality and environment resources. He collected data of 213 households from the rural areas of the Zimbabwe. He concluded that environmental degradation had reduced 30 percent national income.

2.1 Distinction of this study:

This study is distinguished from the above quoted studies because it has different study period, different methodology and different variables. In this study, we have analyzed relationship between economic growth and environmental degradation. As per our knowledge no study has so far been conducted on this topic. Our study period is spread over 31 years from 1984 to 2015.

3.CONCEPTUAL FRAMEWORK

3.1 Rio Conference

The World conference of 178 states held in Rio de Janeiro in 1992 under sponsorships of UNCED (United Nations Conference on Environment and Development), generated debate to determine is the relationship between population growth, economic growth and the natural environment. The conference developed consensus that there are strong relationship between environmental resources and sustainable development and emphasized that existing resources should be used in such a way that it cannot only meet the requirement of existing generation but also of future generation.

3.2 Malthusian Theory:

Malthusians are of the opinion that the normal resources are flawed and finally the hominid population loud volume of the earth is surpassed. The main

thrust of this theory is that population growth rate must be controlled otherwise natural calamities, wars, earthquakes and famine balances it.

2. Neoclassical Theory:

Alfred Marshal is one of the founders of neoclassical economics. He and other economists were the view that market expansion, development of new technology and improved living condition have imposed stress on natural environment. The rising competition among business firms force them to exploit maximum resources to enhance their profitability. It would ultimately affect natural resources and environment.

3.3 Boserupians' Theory:

Esther Bozerup (1996) presented hypothesis about changes in agriculture. He noted that the increase in demand in the agricultural landscape view to increase the production of food products. He concluded that some resources become smaller, for example, to land, technology, adopted more intensively uses the relatively more abundant factor (labor). Rapid growth in population growth in the in the developing countries would cause natural degradation and exert pressure on resources.

4.RESEARCH METHODOLOGY:

4.1 Type and source of Data:

We have used time series secondary data spreading over a period of 31 years from 1984 to 2015. The data of selected variables has been collected from the databases of World Development Indicators (WDI), World Bank, IMF, Asian Development Bank, State Bank of Pakistan, relevant research papers and books.

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4.2 Selected variables:

Gross domestic product (annual growth rate) has been taken a dependent variable while agriculture growth rate, education spending as percentage of GDP, Health expenses as percentage of GDP, household expenses and inflation rate are taken as independent variables.

4.3 Analytical Techniques:

In order to check stationary in the data and order of co-integration we used Augmented Dickey Fuller (ADF) test. Autoregressive distributed lag (ARDL) model was used to see whether the variables are integrated at level 1 (0) and 1 (1) to ascertain lag in the model. If all selected variables are integrated at 1 (0) order, then a simple Ordinary Least Square (OLS) method will be used and if order of integration is at the 1 (1) level then ARDL approach will be used.

4.4. Model Specification:

We engrave our model in the following equations: -

$$CO2 = \beta_0 + \beta_1 AGG + \beta_2 EE\_GDP + \beta_3 HE + \beta_5 HHCE + \beta_6 INF + \varepsilon_i \quad (1)$$

Whereas,

ε_i= Error term

β_0= intercept term

$B_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ =slope coefficient

General Auto regressive distributed lag (ARDL) model is shown as follows;

$$\Delta(CO2)_t = \gamma_0 + \sum_{i=1}^{a} \gamma_1(CO2)_{t-i} + \sum_{i=0}^{b} \gamma_2(AGG)_{t-i} + \sum_{i=0}^{c} \gamma_3(EE\_GDP)_{t-i} + \sum_{i=0}^{d} \gamma_4(HE)_{t-i} + \sum_{i=0}^{e} \gamma_5(HHCE)_{t-i} + \sum_{i=0}^{e} \gamma_6(INF)_{t-1} + \gamma_7(CO2)_{t-1} + \gamma_8(AGG)_{t-1} + \gamma_9(EE\_GDP)_{t-1} + \gamma_{10}(HE)_{t-1} + \gamma_{11}(HHCE)_{t-1} + \gamma_{12}(INF)_{t-1} \dots \dots$$

$$(2)$$

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Equation 2 is the Auto regressive distributed lag mode which denotes the long run and short run relationship between dependent and independent variables. γ_0 is the intercept term and short run coefficient of the determinants are as follows $\gamma 1, \gamma 2, \gamma 3, \gamma 4, \gamma 5, \gamma 6$ and the long run coefficients of the variables are $\gamma 7, \gamma 8, \gamma 9, \gamma 10, \gamma 11, \gamma 12$ whereas, ε_I is the error term.

4.4 Long Run Relationship:

The F-statistics were used to rummage-sale to checkered the long track connotation amid reliant on and sovereign variables. The long run relationship between dependent and independent variable is shown in the following equation.

$$(CO2)_t = \alpha_0 + \sum_{i=1}^{Z1} \alpha 1i(CO2)_{t-i} + \sum_{i=0}^{Z2} \alpha 2i(AGG)_{t-I} + \sum_{i=0}^{Z3} \alpha 3(EE\_GDP)_{t-i} + \sum_{i=0}^{Z4} \alpha 4(HE)_{t-i} + \sum_{i=0}^{Z5} \alpha 5(HHCE)_{t-i} + \sum_{i=0}^{Z6} \alpha 6(INF)_{t-i} + \varepsilon_i \ldots \quad .(3)$$

4.5 Short Run Relationship:

The short run relationship between dependent and independent variables is shown in the following equation. Error correction Model lagged as (ECM) t-1 is added in the equation to adjust the speed.

$$\Delta(CO2)_t = \gamma_0 + \sum_{i=1}^{k1} \gamma 1i(CO2)_{t-i} + \sum_{i=0}^{k2} \gamma 2i(AGG)_{t-i} + \sum_{i=0}^{k3} \gamma 3i(EE\_GDP)_{t-i} + \sum_{i=0}^{k4} \gamma 4i(HE)_{t-i} + \sum_{i=0}^{k5} \gamma 5i(HHCE)_{t-i} + \sum_{i=0}^{k6} \gamma 6i(INF)_{t-i} + \lambda(ECM)_{t-i} + \varepsilon_I \ldots$$
$$(4).$$

(ECMt-i) is the error correction model that shows the short run effect of X on Y variable and speed of adjustment.

$$\Delta P_t = \gamma + \delta \Delta_{t-1} + \lambda (ECM_{t-1}) + \varepsilon_I \ldots \ldots \quad (5)$$

ECM_{t-i} error correction term is shown by equation 5, in this equation δ shows the short run effect and λ shows speed of adjustment. Disequilibrium value is shown by the error term.

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4.6. Hypothesis of study:

4.6.1 Null Hypothesis:

There is no long run relationship between economic growth and environmental degradation in Pakistan.

$H_0 = \gamma7, \gamma8, \gamma9, \gamma10, \gamma11, \gamma12 = 0$

If no long run relationship exists, then null hypothesis is accepted.

4.6.2 Alternative Hypothesis

There is long run relationship between economic growth and environmental degradation in Pakistan.

$H_1 = \gamma7, \gamma8, \gamma9, \gamma10, \gamma11, \gamma12 \neq 0$

If long run relationship exists, so alternate hypothesis is accepted.)

5. DATA ANALYSIS

5.1 Descriptive statistics:

The descriptive statistics, mean, standard deviation, Kurtosis, J.B and probability results are shown in Table 1:

Table 1: Descriptive statistics

Variables	mean	St. dev.	skewness	kurtosis	J.B.	Prob.
CO2	0.620929	0.217355	0.158016	1.763747	2.849743	0.240578
AGG	3.512135	3.719516	-0.220654	3.379671	0.593078	0.743387
EE_GDP	2.295412	0.379705	0.031168	2.093400	1.445168	0.485496
HE	2.277126	0.573639	0.166285	1.900320	2.309824	0.315085
HHCE	4.433896	6.029157	0.480015	4.554002	5.839016	0.053960
INF	9.354541	5.392094	1.437763	4.956204	21.16693	0.000025

The value of Kurtosis shows that the mutable is platy kurtic or leptokurtic. Households spending and inflation rate has a high sickly-looking or

leptokurtic delivery, whereas CO_2, agriculture growth rate, teaching outlay as fraction of GDP and health spending variables are platy kurtic. Jarque- Bera test of ordinariness shows the joint results of kurtosis and skewness. JB test of ordinariness demonstrations that the 'p' calculated value of increase degree is very low, are not usually dispersed, whereas, all other variables are usually dispersed.

5.2 Augmented Dickey Fuller Test:

The results of ADF test are shown in Table 2

Table 2: Results of ADF Test

Variables	At level		At 1st Difference		
	Intercept	Intr. & trend	Intercept	Intr& trend	Integration
CO2			-6.05954	-	I (1)
AGG	- 8.63989	-	-	-	I (0)
EE	- 2.96151	-	-	-	I (0)
HE	-	-	-5.28365	-	I (1)
HHCE	- 7.84414	-		-	I (0)
INF	-	-	- 6.25262	-	I(1)

Source: Author's calculations

We have used Augmented dickey fuller (ADF) test to check the stationary of the dataset either it has a unit root or not. The data in table 2 shows mix trend of co-integration as some variables are integrated at level as agriculture growth rate, education expenditure percentage of GDP and household consumption expenditure, while some are integrated at 1st difference as CO_2, health expenditure and inflation rate. So we can use ARDL model

5.3 Bound Test for Co-integration

The results of Bound Test are shown in Table 3.

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Table 3: Results of Bound

Equation	F-Statistics Calculated	Lower Bound Critical Value	Conclusion
Equation (1) CO_2 **/** AGG, EE, HE, HHCE, INF	2.39 [0.0118]	2.26 (90%)	Co-integration exist

Source: authors' calculation,

The data in table 3 shows computed F-statistics: 2.39 (significance at 1% marginal values). Critical values at k = 6-1= 5 is cited from Pearson et al (2001), case 111: unrestricted intercept and no trend. The numbers in parenthesis shows the probabilities of F-statistics. Bound test shows that all the variables have long run relationship.

5.4 ARDL Approach:

Dependent Variable: CO_2

Method: Least Squares

Sample: 1984-2015

Included observations:41

Tables 4 Results of ARDL Model

Variable	Coefficient	Std. Error	T-Statistic	Prob.
C	-0.154888	0.049180	-3.149395	0.0033
AGG	-0.000810	0.002299	-0.352319	0.0267
EE	-0.047054	0.024576	-1.914631	0.0635
HE	0.387001	0.105977	24.22275	0.0000
HHCE	0.002020	0.001390	1.452984	0.0549
INF	-0.000378	0.001454	-0.259894	0.094

To check the relationship between economic growth and environmental degradation in Pakistan, Auto reverting distributed lag (ARDL) model has

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been used. In the long run relation between variables is explained. As the value of coefficient of agriculture growth shows that one-unit increases in agriculture growth rate will cause -0.0008-unit decrease in environment degradation and it is statistically significant. Similarly, one-unit increasing in education spending in Pakistan will reduce environmental degradation by -0.047- % and it is significant at 10% level. The value of coefficient of health shows that one-unit increase in health expenditures will cause 38% increase in environment degradation and it is statistically significant. The value of coefficient shows that one-unit upsurge in households' expenditure will likely to cause 0.0020 % change in environment degradation and it is statistically significant. The value of coefficient shows that one-unit upsurge in inflation will probable to cause -0.000378% decrease in environment degradation and it is statistically important. The behavior of independent variables demonstrations that here exist long run relationships between economic growth and environment degradation in Pakistan. Some variables are causing environment degradation, while some others are reduction it in the long run.

5.5 Error Correction Model:

5.5.1 Short run relationship:

The results of ECM are shown in Table 5

Dependent Variable: D (CO2)

Method: Least Squares

Sample (adjusted): 1984-2015

Included observations: 39 after adjustments

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Table 5. Results of Error Correction Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010713	0.003953	2.710049	0.0118
D(CO2(-2))	0.244354	0.161099	1.516787	0.1414
D(AGG)	-0.000228	0.000674	-0.338566	0.0377
D(AGG(-2))	0.001164	0.000630	1.848633	0.0759
D(EE)	-0.023337	0.016115	-1.448149	0.0595
D(EE(-2))	0.000687	0.016281	0.042174	0.9667
D(HE)	0.063558	0.028951	2.195361	0.0373
D(HE(-2))	-0.030368	0.039500	-0.768813	0.4489
D(HHCE)	0.001146	0.000546	2.099993	0.0456
D(HHCE(-2))	0.000986	0.000604	1.632373	0.1147
D(INF)	0.002303	0.001057	2.179133	0.0386
D(INF(-2))	0.000955	0.000786	1.215683	0.2350
ECT(-1)	-0.238412	0.102692	-2.321615	0.0284

We have used Error Correction Model (ECM) to measure short run relationship between variables. The results in Table 6 shows that the agriculture growth rate, education expenditure, health expenditure are positive and significant relationship with the environment degradation, while inflation rate and household consumption expenditure are negative and significant relationship with the environment degradation in short run. In long run inflation rate has positive and significant relationship with environmental degradation but in short run it has negative and significant relationship.

5.6 Regression Analysis:

The results of regression analysis are shown in Table 6.

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Table 6: Results of Regression Analysis

R-squared	0.581595	Mean dependent variable	0.016220
Adjusted R-squared	0.242331	S.D. dependent var	0.023062
S.E. of regression	0.020074	Akaike info criterion	-4.717596
Sum squared residual	0.010477	Schwarz criterion	-4.163076
Log likelihood	104.9931	Hannan-Quinn criter.	-4.518639
F-statistic	2.012818	Durbin-Watson stat	2.107896
Prob (F-statistic)	0.025895		

R-squared value is .58.15 which shows that our dependent variables have 58% variation due to one unit change in independent variables, while the other 42% variation is due to error term (stochastic variable). It also shows that the model is "goodness of fit". The probability value of F- statistics is below the 5% (0.025%) which shows the overall significance of the model. F- Statistics value 2.1078 which is near about 2 so we can conclude that there is no autocorrelation between variables.

5.7 Stability test:

We have estimated the CUSUM stability through Auto Regressive Distributed Lags (ARDL) method to show the stability of the data. Our variables and data are stable because the cumulative sum of recursive residuals CUSUM graph is within the range of 5% significance level and cumulative sum of square of recursive residuals CUSUMSQ graph is also within the limits of 5% significant. The results of stability test are shown in Figure 1.

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Figure 1: Stability test
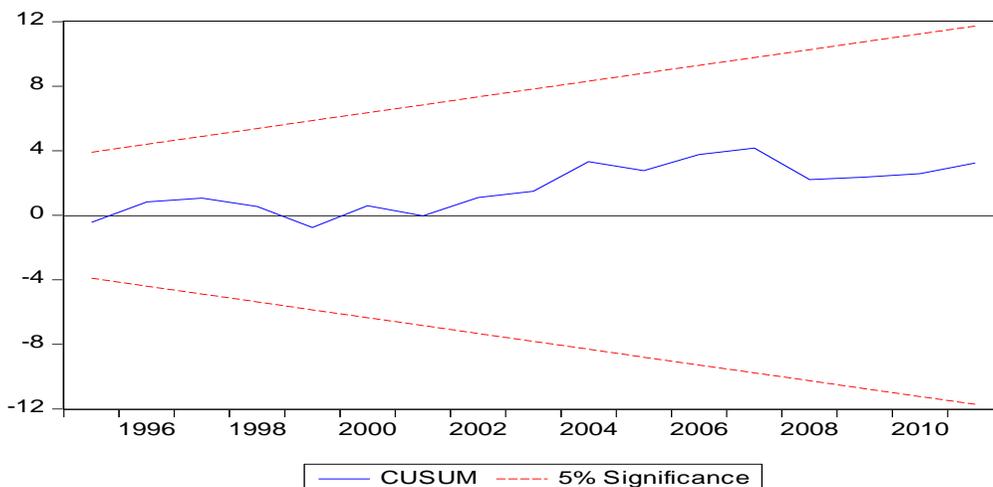
5.8: Diagnostic Test:

Diagnostic test was conducted to check serial correlation and heteroscedasticity in the variables. The results of test are shown in Table 7:

Table 7: Results of diagnostic test

Test Statistics	LM Version	F Version
Serial Correlation	.011611[.701]	F(1, 26)=.012022[.921]
Functional Form	1.01112[.281]	F(1, 26)= .79153[.372]
Normality	.1877[.805]	Not applicable
Heteroscedasticity	3.2205[.068]	F(1, 36)= 3.2085[.082]

Diagnostic test results show non-existence of serial correlation and heteroscedasticity in the variables.

6.FINDINGS AND RESULTS

In this research paper we have ascertained relationship between economic growth and environmental degradation. We used data from 1984 to 2015. Our dependent variable was GDP while independent variables include

agriculture growth rate, household consumption expenditures, education and health expenditures and inflation rate. ADF test was used to check stationarity between variables while ARDL's bound test was applied to check long run relationship between variables. Error correction model was used to check short run relation between variables. Regression analysis was used to check variation in dependent variable due to change in independent variables.

The findings of our study shows negative relationship between agriculture growth and environmental degradation while education spending has positive association with environmental degradation. However, health expenditures have negative relationship with environmental degradation while household consumption expenditures have positive relationship with environmental degradation. The inflation rate has negative relationship with environmental degradation. The value of R^2 shows that 58 percent change in dependent variable is due to independent variables while 42 percent variations in dependent variable is due to other unexplained factors. The probability value of f-statistics below 5 percent shows that model is goodness of fit while the calculated value of f-statistics 2.1078 shows there is no autocorrelation between variables.

7. CONCLUSIONS:

From the above results we draw the conclusion that the government must increase education expenditures because educated people have awareness about environmental degradation and play their positive role in its reduction. Similarly, the government should control inflation rate because higher prices of goods and services tempt the manufacturers to produce more and more to earn high profit while low inflation reduces their temptation to attain high level of production. The government should also focus on reduction

of poverty because high level of poverty and low income force the people to consume more and exploit more natural resources to meet their needs.

8. POLICY RECOMMENDATIONS:

The policy recommendations are given below: -

► The government must encourage the recycling of existing resources so that they may be used for a long time.

► The government should generate awareness about environmental degradation and its possible effects on natural resources and human health.

► Government must develop forestation and plantation in the country to promote clean environment. Similarly, the government must encourage the use of bio-fuel in the vehicle to reduce vehicle emission.

► Government must discourage the use of petroleum products having high volume of Sulphur and introduce environment protection laws.

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CONTRIBUTION OF AUTHORS AND CONFLICT OF INTEREST

This research work was carried between collaboration of two authors.

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Both authors read the manuscript carefully and declared no conflict of interest with any person or institution.