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IMPACT OF FOREIGN DIRECT INVESTMENT, POPULATION DENSITY, CONSUMPTION OF OIL AND GAS ON ENVIRONMENTAL DEGRADATION IN PAKISTAN

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ABSTRACT

This study focuses on the factors which have destructive impacts on climate in Pakistan. Carbon-Dioxide Emission is taken as the proxy of the environmental degradation in Pakistan and taken as the dependent variable. Foreign Direct Investment, Population Density, consumption of gas and consumption of oil are taken as independent variable. Time Series Data from 1993 to 2021 is used and OLS technique is used to estimate the results. Our empirical evidence concludes that foreign direct investment, population density, oil consumption and gas consumption have significant effect on CO2 emission in Pakistan.

Keywords: Foreign direct investment, Environmental Degradation, Pakistan
JEL Codes: F21, K32

I. INTRODUCTION

Foreign Direct Investment (FDI) is an investment in business interests in another nation undertaken by a firm or a person from one country, either via the establishment of business activities or the purchase of business assets in the other country. Additionally, it refers to the acquisition or creation of revenue-generating assets in a foreign nation that involves management of business activities or organizations (Raza et al., 2021). Investors have two options: they either support emerging sectors or invest in already established ones. FDI is a crucial source of funding for fostering entrepreneurship and economic growth. It has a tremendous impact on the economies of the nations and the businesses that get this sort of investment (Wasti & Zaidi, 2020). Lahiri and Ono, 2015 noted that less environmental laws, cheaper labour costs, large markets, and subsidy packages in host nations function as pull factors. Push factors are the primary causes of FDI influx and outflow. These elements entice international investors to invest in this nation. Although rigorous environmental laws and relatively high labour expenses serve as motivating elements (Shehzadi & Majeed, 2019). Many sectors that produce a lot of pollution moved from nations with tight environmental rules to those with lower incomes and comparatively fewer environmental restrictions. The imposition of environmental regulatory laws imposes costs on both foreign investors and the host nation in the form of slow productivity development. Environmental laws start to limit the host nation's capacity for production (Naz et al., 2021). Consequently, a nation loses its capacity to compete in global markets. As a result, the nation's exports decline while its imports increase. Trade imbalances in the nation decrease, but export prices increase. Therefore, the only option for the nation is to devalue its currency. As a result, exports are relatively cheaper for overseas consumers while imports become more expensive. The world has witnessed a significant infusion of FDI into developing nations during the past 20 years (Baksh et al., 2017). Developing nations are increasingly vying with one another to entice this kind of investment. As the necessity of these investments is understood, restrictions that were previously in place are now being lifted. Additionally, the government is introducing fresh regulations and initiatives to encourage an increasing amount of this investment. Foreign direct investment progressively grew from 2015 to 2018. The period from 2015 to 2018 was beneficial for Pakistan's economy (Solarin et al., 2017). With 210.7 million diligent citizens, Pakistan is reportedly the fifth-most populated nation in the world in 2019. There are no restrictions on bringing in or withdrawing money in Pakistan, and both domestic and international investors are welcome to participate in every field. In order to stimulate investment activity in Pakistan, the Pakistani government wants to motivate investors. Through Pakistan, foreign investors may access Central Asia, increasing the amount of international commerce (Khan et al., 2021). In poorer countries, globalization also contributes to environmental damage. It has two ways to affect the environment.

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The first is pollution havens, when polluting industries migrate from developed to poor countries as a result of globalization (Ali and Muhammad, 2021). It's because less environmental rules apply in those emerging nations than in wealthy nations. As a result, it contributes to environmental damage. The environmental Kuznets curve comes in second. It explains that the revenue of a nation and its amount of pollution have an inverse U-shape connection. The acute lack of food and water caused by climate change, according to Taghavee et al. (2016), makes it a critical issue for humans. Additionally, it becomes a major issue for those who breathe in dirty air. Water pollution affects aquatic life as well. Due to water contamination, many aquatic species have become extinct throughout time. The last point, which is crucial to economists, is that each unit of temperature increase results implies a decline in income globally of between one tenth and one percent (Omedero & Alpheaus, 2019). The study's goals are to determine the amount of emissions of CO_2 and the effects of various variables on those emissions in Pakistan.

II. LITERATURE REVIEW

Zahu et al. (2016) conducted study the FDI, GDP on the 5-ASEAN countries' carbon emissions: Panel Quantile Regression data evidence. Panel data was used in this study. The authors used tests for the purpose of estimation. panel unit root test, Johansen fisher panel cointegration test, OLS regression, panel quantile regression, robustness analysis and Wald test. The aim of this study was to show the effect on CO_2 emissions of FDI, economic growth, and energy use. The results were given that Consumption of energy significantly and positively affects CO2 emissions. The impact of FDI was positively. CO2 emissions amplified as a consequence of increased FDI.

Hakim and Hamdi (2016) carry out the study on FDI, Trade Liberalization, Environmental Quality and Economic Growth (EG): analysis among Morocco and Tunisia comparatively. The authors used time series data. The authors used VECM and cointegration technique When doing a single-country study, used Panel Co-integration and Panel VECM while utilizing data from both nations taken together. The findings indicated that A negative effect of trade liberalization on the state of the environment. It was determined that trade liberalization increased economic activity in the nations, but it was still bad for the country's ecology.

Baksh et al, (2017) assessed the research on FDI, emissions of CO_2, renewable waste, and economic growth in Pakistan: fresh data from 3SLS. 3SLS was utilized for estimate. The Scale-Effect, composition effect, and method effect were used in this study to illustrate how FDI has an impact on the environment. Scale effect, it was determined, demonstrates that labor and physical capital stock have a favorable effect on GDP whereas pollution has impact negatively. The effects of FDI on CO2 and renewable waste were unfavorable. Capital Stock and Road length exhibited a positive correlation with CO2 in the composition impact, but GDP per capita had a negative correlation.

Bokpin (2017) research on African FDI and environmental sustainability: the function of governance and institutions was investigated. The author used 24-year panel data to demonstrate how FDI imports affected the sustainability of the environment in Africa. In this study, OLS estimation approach was employed. This study investigated how governance and institutions affect how FDI concern environmental degradation. It was determined that an augment in FDI inflows had a detrimental effect on the environment's sustainability. The sustainability of the environment is positively impacted by FDI if the government is run properly, and institutions are established.

Solarin et al. (2017) provided the paper on the empirical inquiry of Ghana's status as a pollution refuge. The auto regressive distributive lag (ARDL) technique and time series data (1980–2012) were utilized by the authors to estimate their results. investigating in Ghana the pollution haven hypothesis (PHH) was the purpose of this. Air pollution was identified using CO2 emission. The following factors were the main causes of pollution: GDP, GDP^2, energy utilization, consumption of renewable and fossil fuels, FDI, urbanization, institutional quality, and trade openness. Conclusion: CO2 emissions are positively impacted by GDP, FDI, urban population, financial development, and international commerce; improvements in institutional quality also resulted in lower CO2 emissions in Ghana.

III. DATA AND METHODOLOGY

In this section we are going to explain about data, sources of data from which data have been collected, description of variables and methodology which we have been used in our analysis. In descriptive statistics mean and standard deviation is explained. Mean is defined as the central value of the data and standard deviation talks about the spread of the data from central value. The data's stationarity is examined using the Augmented Dickey-Fuller (ADF) test. White LM test is used to deduct the heteroscedasticity in the results of regression. VIF is used to test whether multicollinearity exists in the data and to check the autocorrelation; Durbin-Watson statistic is utilized in the data. Jarque-Bera (JB) test is used to check the residuals' normality.

III.I DATA AND DATA SOURCES

In this study we have used annual Time Series data from the phase 1993 to 2021. Data CO2 and population density is compiled from world development indicators (WDI) for Pakistan. Data of FDI, oil and gas is taken from the source state band of Pakistan (SBP). Data on carbon dioxide is measured as kt, FDI is measured as total FDI million dollars, population density is measured as number of populations persons per sq km area of land, oil is measured as tons and gas is measured as$(mmcft)$.

IV. DESCRIPTION OF VARIABLES

The variables which are used in this study are explained as below.:

IV.I. CARBON DIOXIDE (CO2)

It is a pollution emission which is created through the different sources like fuel consumption, machinery etc. It is affecting the ozone layer, which has many bad impacts on human health. It is the variable which is used in this study as a proxy of pollution (Nawaz et al., 2021).

IV.II. FOREIGN DIRECT INVESTMENT (FDI)

The World Bank claims that "FDI is defined as the investment made to acquire a lasting management in an enterprise operating in a country other than that of the investor. FDI is an investment through by a corporation or person in one country in business interests in another country, in the type of each establishing big business operations or acquiring business assets in the other country, such as ownership or controlling interest in a foreign company" (Ibrahim et al., 2021).

IV.III. GROSS DOMESTIC PRODUCT (GDP GROWTH)

"GDP growth rate is the rate at which nation's Gross product (GDP) changes/ grows from one year to another year." While GDP measures the total market value of all goods and services produced in a nation during a given year. (Carkar et al., 2021).

IV.IV. ENERGY CONSUMPTION

Energy consumption is the amount of energy or power consumed by an individuals or organization, or to the process or system of such consumption. It includes electricity used by for consumption or production purposes, or use of fuel by households or factories. This study included two factors of energy consumption from oil and gas.

IV.V. POPULATION DENSITY

"Population density is the number of people living per square km of the land area"
In our research:
CO2 = carbon dioxide
FDI = foreign direct investment
POPD = Population density
OIL = Use of energy in form of oil
GAS = Use of energy in form of gas

IV.VI. DESCRIPTIVE STATISTICS

Descriptive statistic shows the essential characteristic of the data. Descriptive statistics shows the average values of variables and trend of the variable over a time period. It displays numerical descriptions in a feasible form and give manageable sketch about data. Descriptive statistics explains the variation in the data explain while inferential statistics is utilized to obtain conclusions that expand beyond the single immediate data alone. Mean show the central tendency of the entire data. It describes a single value around which whole data is located. Standard deviation shows how much values are located for away from central value. If value of the standard deviation is small, then there is stability in the variable.

IV.VII. UNIT ROOT TEST

Checking the stationarity of the variables is the goal of the unit root test whether the variables are stationarity or not. When conditions like mean, variance, and covariance are determined to be time invariant, the time series data is said to be stationary. Any series, for instance, like Y_t, is referred to as stationary, if the following requirements are met for all "t" values.

E $(Y_t) = \mu$(1)
VAR (Y_t) = E $(Y_{t-\mu}) = \sigma^2$(2)
COV (Y_t, Y_{t+s}) = COV $(Y_t, Y_{t-s}) = \gamma_s$ (3)

Equation resulted that series' mean is constant and has constant variance. But equation (3) demonstrated that the covariance between any two values of Y from the series depends solely on the interval of time between those two values, not on the exact moment in time (t). The letters "s" in equation (3.3) stands for the interval of time between two subsequent values of the time series Y and for the time period. The probability distribution of the data's mean, variance, and covariance is time-dependent; hence the time series data must be nonstationary In order to verify the stationarity of the variables using the unit root test, Dicky and Fuller (1979) developed the notion of Augmented Dicky-Fuller. Check the data's stationarity at order I(0) first, which indicates that it is stationary at the level where nothing has been done to make it stationary. If this criterion is not met, order I must be made stationary (1). If this is likewise true, then we must make it stationary at order I(2). If the series needs the difference to become stationary,

then the series will be integrated at order Z t I. (d). The random walk model is characterized as time series data that travelled upwards or downwards without any discernible patterns, and if the series had a definite pattern moving upwards or downwards, it was referred to as a random walk with a drift similar to the Auto Regressive (1) technique.
$Y_t = \alpha + Y_t + \epsilon_t$ (4)
If | ρ | < 1 then equation (4) is stationary. If | ρ| = 1 then AR (1) method in equation (4) reduce to Random walks that are not stationary. If these circumstances fulfill $\alpha = 0$ and | ρ | = 1 and in occasion of random walk with drift of $\alpha \neq 0$ and | ρ | = 1
If the data is stationary at level form them solution is I(0). If the data is stationary at first difference then solution is I(1). If the data is stationary at second difference then our solution is I(2).

IV.VIII. AUGMENTED DICKEY-FULLER (ADF) TEST

To determine if the data are stationary, the enhanced Dickey Fuller test is performed. We'll use the ADF test to add serial correlation probability to the error term. Regressions made by them support ADF.
Equation 1 is with no Constant Trend
$Y_t = \rho Y_{t-1} + \varepsilon$ (5)
Equation 2 with Constant
$Y_t = \alpha + \rho Y_{t-1} + \varepsilon_t$ (6)
Equation 3 with Constant and Trend
$Y_t = \alpha + \rho Y_{t-1} + \beta_t + \varepsilon_t$ (7)
where
Y_t = Time Series Relevant
α = intercept (constant)
t = trend in Time
ε = residual (Error) term
Our Null and Alternative Hypothesis are
$H_0: \rho = 1$ (Non-stationary Data)
$H_1 : \rho \neq 1$ (Stationary Data)
Null-Hypothesis is rejected if ADF>t critical value and concluded that stationary data; and Null Hypothesis not rejected if ADF<t critical and then it is concluded that data is not stationary.

IV.IX. WHITE'S TEST

White (1980) created a more comprehensive test for heteroskedasticity that fixes the issues with the earlier tests. The White's test is an LM test as well, but it differs from the Bruesh-Pagan test in that it (a) assumes no previous knowledge of heteroskedasticity, (b) is not dependent on the normality assumption, and (c) offers a specific option for the Zs in the auxiliary regression. The procedures for White's test on the presumption that the model here has two explanatory variables:

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \mu_i$$

are the following:
Step 1: To get the residuals I for this regression equation, run a regression on the above model.
Step 2: Run the auxiliary regression listed below:
$\mu_i^2 = a_1 + a_2 X_{2i} + a_3 X_{3i} + a_4 X_{2i}^2 + a_5 X_{3i}^2 + a_6 X_{2i} X_{3i} + v_i$
i.e. regress the squared residuals on a constant, each and every explanatory variables, the squared explanatory variables, and their respective cross products.
Step 3: Create the null and alternate hypotheses. The following is the homoskedasticity's null hypothesis:
$H_0 : a_1 = a_2 = \cdots = a_p = 0$
Though the alternative hypothesis is that minimum one of the a's is differ from zero.
Step 4: Calculate the LM = nR^2statistic, where n is the quantity of data utilized to calculate the auxiliary in step 2 and R^2 is the regression's coefficient of determination. The LM statistic has a 6-1 degree of freedom and follows the chi square distribution.
Step 5: When the LM statistic exceeds the crucial value, reject the null hypothesis and come to the conclusion that there is strong evidence of heteroskedasticity. As an alternative, if the p-value is smaller than the level of significance, reject the null hypothesis. α (usually, $\alpha = 0.05$).
White's test is preferred above all the earlier tests because it is broader and because of the benefits it offers, but one practical issue is that because of the cross product terms, the number of regressors might grow significantly.

IV.X. MODEL

This study uses linear regression model. In this study we have used ordinary least square for estimating the results of the study. OLS is a technique for estimating the unknown parameters in a linear regression model with the aim of

minimizing the sum of the squares of the differences between the observed responses (values of the variables being predicted) in the given data set and those predicted by a linear function of a set of explanatory variables. Each data point in the set and its corresponding point on the regression line are multiplied by two to get the total of the squared vertical differences; the fewer the differences, the better the model matches the data. According to Gujrati, OLS have following statistical properties. In terms of observable variables, OLS estimators are stated. They are readily calculable. Since they are point estimators, each one returns a single result. Once the OLS estimates from the sample data have been determined. Obtaining a sample regression line is simple. BLUE are the OLS estimators. Which are best linear unbiased estimators. It is linear in the sense that dependent variable should be linear function of explanatory variable. It is unbiased in the sense that average value of the parameter is equal to true population parameter. It is blue in the senses that it has minimum variance among the class of linear unbiased estimators. In this model log of all the variables are taken. We have used log of CO2 as dependent variable and log of foreign direct investment, log of population density, log of Oil consumption, log of Gas consumption are used as independent variables.
Functional form of our model becomes

LCO2 = f (LFDI, LPopD, LOil, LGas) **(**8)

The equation becomes

LCO2 = $\beta_0 + \beta_1 LFDI + \beta_2 LPopD + \beta_3 LGas + \beta_4 LOil$ (9)

But there are many other variables, which can effect CO2 emission which is not included in model. Due to these variables, we add a error term in above equation.

LCO2 = $\beta_0 + \beta_1 LFDI + \beta_2 LPopD + \beta_3 LGas + \beta_4 LOil + \epsilon_t$ (10)

Where $\in_t$ is the error term. It shows the average effect of all additional factors that are not accounted for in the model. There are several studies which uses carbon dioxide as dependent variable. In our study CO2 is taken as the proxy of pollution with the reasons first, Since CO2 is regarded as the main greenhouse gas causing global warming, its regulation has been a crucial intergovernmental problem. Additionally, trustworthy time series data on CO2 emission are easily accessible. (Ging and Yeung, 2005).

V. EMPIRICAL RESULTS AND DISCUSSIONS

The value shown in bracket is standard deviation and the value outside the bracket shows mean value of the variables. Table 1 shows the descriptive statistics of carbon dioxide, foreign direct investment, gas, oil and population density. In this table data is broken down into six time periods which are 1993-1998, 1999-2003, 2004-2008, 2009-2013, 2014-2018 and 2019-2021.Average value of CO2 during the period 1993-1998 is 56316.13 and standard deviation is 7919.13. During the period 1999-2003 average value of Co2 is 77672.93 and standard deviation is 7256.64. Average value of the period 2004-2008 is 98731.04 and standard deviation is 4948.59. In period 2001-2005 average value of CO2 is 121899.9 and standard deviation is 11903.92. During the period 2009-2013 the average value of CO2 is 156854.5 and standard deviation is 6120.1. Average value of CO2 during the period of 2014-2018 is 159479.1 and standard deviation is 5317.89. The results demonstrate that there is a significant rise in the CO2 emission during the period 2019-2021 and standard deviation of different periods shows that there is a large variation in CO2 emission during the period of 2001-2005.During the period of 1993-1998 the average value of foreign direct investment is 164.13 US million Dollars and standard deviation is 47.39. Average of FDI during the period 1999-2003 is 681.76 and standard deviation is 499.02. During the period 2004-2008 average value of FDI is 824.4 and standard deviation is 328.98. In period 2009-2013average of FDI is 815 with standard deviation 563.54. Average value of the period 2014-2018 is 43617.02 and the standard deviation is 1844.18. Average value of the period 2019-2021 is 1445.3 with the standard deviation 629.61. The results shows that there is large increase in foreign direct investment during the period 2014-2018 and a large variation can be observed during this period.

Table 1: Descriptive Statistics

Years	**CO2 (kt)**	**FDI (Total FDI in million dollars)**	**PopD (Per sq.km)**	**Gas($mm\ cft$)^1**	**Oil(tons)**
1993-1998	56316.56 (7919.13)	164.13 (47.39)	129.55 (7.51)	397751.7 (48955.1)	8717766 (11884157)
1999-2003	77672.93 (7256.64)	681.76 (499.02)	151.25 (6.13)	535711.6 (3714.18)	13156329 (1779122)
2004-2008	98731.04 (4948.59)	824.4 (328.98)	171.22 (6.44)	6643349.8 (73253.44)	16858768 (882903)
2009-2013	121899.9 (11903.92)	815.0 (563.54)	191.06 (6.18)	1026543 (174669.1)	15226620 (1451909)
2014-2018	156854.5 (6120.1)	4367.02 (1844.18)	211.69 (6.93)	1257026 (24555.16)	17771391 (1714662)
2019-2021	159479.1 (53317.89)	1445.3 (629.61)	230.15 (4.88)	1258890 (34755.69)	19726692 (1249074)

Average value of the population density for the period 1993-1998 is 129.55 with the standard deviation 7.51. During the period 1999-2003 average value is 151.25 with standard deviation 6.13. Average value of population density during the period 2004-2008 is 171.22 with standard deviation 6.44. During the period 2009-2013 average value of population density is 191.06 with standard deviation 6.18. Average value for the period 2014-2018 is 211.69 with standard deviation 6.93. Average value of population density for the period 2019-2021 is 230.15 and the standard deviation for this period is 4.88. The results shows that there is a large increase in population density during the period 2019-2021 and a large variation can be observed in population density during the period 1993-1998. During the period of 1993-1998 average value of gas consumption is 397751.7 and standard deviation of this is 48955.1. Average value of gas consumption during the period 1999-2003 is 535711.6 with standard deviation 3714.18. Average value of gas consumption far the period 2004-2008 is 6643349.8 with standard deviation 73253.44. Average value for the period 2009-2013 is 1026543 with the standard deviation 174669.1. Average value of gas consumption for the period 2014-2018 is 1257026 and standard deviation of this period is 24555.16. Average value of as consumption for the period 2019-2021 is 1258890 and the standard deviation of this period is 34755.69. The results shows that there is a large use of gas during the period 2004-2008 and a large variation can be observed during this period. Average value of oil consumption during the period 1993-1998 is 8717766 and the standard deviation of this period is 11884157. Average value of oil consumption for the period 1999-2003 is 13156329 with standard deviation 1779122. Average value of oil consumption for the period 1996-2000 is 16858768 with standard deviation 882903. Average value of oil consumption for the period 2004-2008 is 15226620 and the standard deviation of this period is 1451909. During the period 2009-2013 average value of oil consumption is 17771391 with standard deviation 1714662. Average value of oil consumption for the period 2014-2018 is 19726692 and standard deviation of this period is 1249074. The results of oil consumption shows that there is a large use of oil during the period 2019-2021 and a large variation in consumption of oil can be observed during the period 1993-1998.

According to Dickey Fuller test values of variables shown in Table 2 carbon dioxide, foreign direct investment, Gas and Oil are stationary at level form while population density is stationary at 1stdifference.first difference. The outcome results of ADF test which are shown in table 2 explain that carbon dioxide, foreign direct investment, oil and gas are integrated in order (0) while population density is integrated in order I(1).

able 3 shows the regression results of the model. R-square explains the goodness of the fit of model. In above table the value of R-square is 0.995512. Probability value of F-statistic is also significant which indicates that overall model is also good fit. It shows that there is significant effect of overall explanatory on the dependent variable CO2. This indicates that change in our dependent variable CO2 is 99.55% explained by foreign direct investment, population density, Gas consumption and Oil consumption. Our model is good fit.

Table 2: Unit Root Test (Augmented Dickey-Fuller Test)

Variables	None	Lag	Intercept	Lag	Intercept and trend	Lag	Results
LCO2	-1.42	1	-4.49	0	-6.12	0	I(0)
LFDI	-4.91	0	-5.01	6	-4.77	6	I(0)
LGas	-4.92	0	-5.01	6	-4.78	6	I(0)
LOil	-4.05	0	-4.91	0	-5.07	0	I(0)
LPopD	-1.78	2	-1.57	2	-8.35	1	I(1)

Table 3: Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.774887	0.786198	-0.985613	0.3342
LFDI	0.030555	0.008921	3.425145	0.0022
LPOPD	0.573293	0.239472	2.393984	0.0248
LGAS	0.433057	0.085516	5.064043	0.0000
LOIL	0.199000	0.059460	3.346795	0.0027
R-squared	0.995512	Mean dependent var		11.50514
Adjusted R-squared	0.994763			
F-statistic	1330.764	Durbin-Watson stat		2.570735
Prob(F-statistic)	0.000000			

The Durbin-Watson value should be near to 2 which is the criteria for the nonexistence of auto-correlation problem. The value of Durbin-Watson statistic is 2.57 which shows that there is a problem of auto-correlation exist in the data. We also check for these results whether multi-collinearity and heteroscedasticity exit.

Table 4: Heteroscedasticity White Test

F-statistic	2.151329	Prob. F(12,16)	0.0767
Obs*R-squared	17.90376	Prob. Chi-Square(12)	0.1186
Scaled explained SS	14.63374	Prob. Chi-Square(12)	0.2621

Table 5: VIF and Tolerance Tests for Multi-collinearity

Variable	R square from	VIF
FDI	0.7229	3.6088
POPD	0.9873	7.7402
OIL	0.9071	1.76
GAS	0.9811	5.9101

Table 6: Solution of Autocorrelation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.706235	0.723490	-0.976150	0.3396
LFDI	0.034215	0.010003	3.420549	0.0024
LPOPD	0.611000	0.178984	3.413719	0.0025
LGAS	0.412779	0.072777	5.671806	0.0000
LOIL	0.198259	0.049412	4.012358	0.0006
AR(1)	-0.533013	0.230607	-2.311346	0.0306
SIGMASQ	0.000529	0.000232	2.282459	0.0325
R-squared	0.996517			
Adjusted R-squared	0.995568			
F-statistic	1049.179	Durbin-Watson stat		2.060972
Prob(F-statistic)	0.000000			

Table 4 shows the results whether the heteroscedasticity exist in our model or not. We have used White test for the deduction of heteroscedasticity and cross products are included. Probability of chi square is 0.1186 which insignificant. Probability value leads us to accept the null hypothesis. Our null hypothesis is that there is no heteroscedasticity in the model. It means that variance of the error term is constant.

Table 5 shows the shows the results of variance inflation factor (VIF) and degree of tolerance (TOL) of multi-collinearity among the variables. We know that the larger the value of VIF the higher the problem of multi-collinearity among the variables. As all the variables have VIF value less than 10 is indication that there is no multicollinearity.

For the existence of no autocorrelation the value of Durbin Watson statistic should be equal to 2. To remove auto-correlation we incorporate auto regressive variable AR(1) as independent variable. Probability value of F-statistic is also significant which indicates that overall model is also good fit. It shows that there is significant effect of overall explanatory on the dependent variable CO2. Coefficient of foreign direct investment is 0.034215. Coefficient of FDI is positive. This indicates that FDI has positive impact on carbon dioxide emission in Pakistan. There is 1% increase in foreign direct investment cause to increase 0.03% in CO2 emissions in Pakistan. Population density has also significant effect on CO2 emission in case of Pakistan. Coefficient of population density is 0.611000. Coefficient of population density is positive. This indicates that population density positively affects CO2 emission in Pakistan. There is 1% increase in population density cause to 0.61% increase in carbon dioxide emissions in Pakistan. Consumption of gas has significant effect on CO2 emissions in case of Pakistan. Coefficient of gas consumption is 0.412779. Coefficient of consumption of gas is positive. This indicates that gas consumption has positively affect CO2 emission in Pakistan. This explain that a 1% increase in gas consumption lead to 0.41% increase in CO2 emissions in case of Pakistan. Consumption of oil also has significant effect on carbon dioxide emissions in Pakistan. Coefficient of consumption of oil is 0.196259. Coefficient of oil consumption is positive. This indicates that consumption of oil positively affects carbon dioxide emission in case of Pakistan. This indicates that a 1% increase in consumption of oil cause to 0.19% increase in carbon dioxide in Pakistan. The figure 1 shows the distribution of the residuals which is bell shaped. It indicates that the distribution of residuals is normal. The curve is symmetrical around the center. Exactly half of the values are to the left of the center and exactly half of the values are right of the center. The total area under the normal curve is always equal to unity.

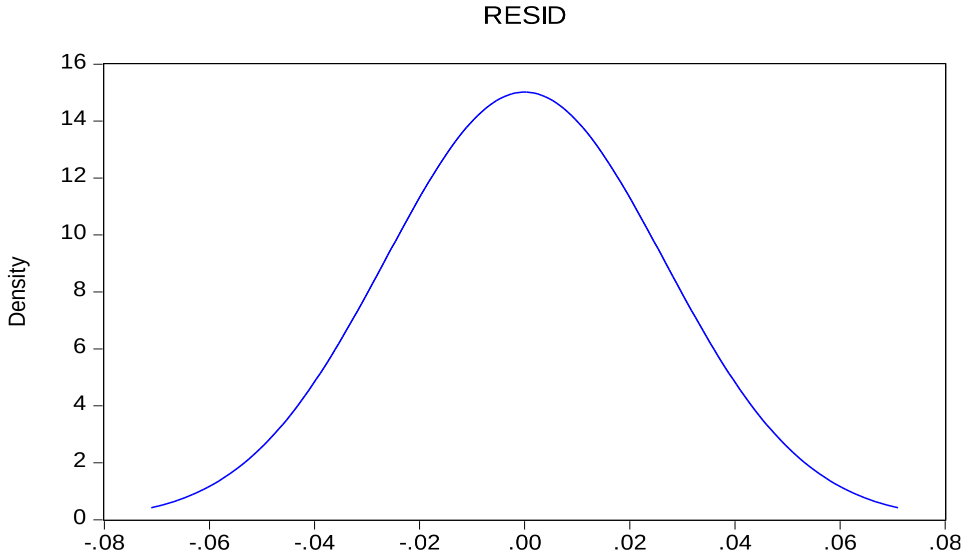

Figure 1: Normality Curve of Residuals

VI. CONCLUSION

This study shows analyze the impact of foreign direct investment, population density, consumption of oil and consumption of gas on carbon dioxide emission in case of Pakistan. The results shows that coefficient of foreign direct investment is positive. This indicates that as the foreign direct investment increase CO2 emission also increases. It shows the positive trend in CO2 emission with the increase in foreign direct investment in Pakistan. Increasing foreign direct investment cause to boom the dirty industries, which cause to increase in carbon dioxide emission in Pakistan. Population density also has positive coefficient. The coefficient of population density shows carbon dioxide emission increase with the increase in population per sq. km of the land area. Due to the rapid increase in population in Pakistan, a rapid increasing trend can be observed in CO2 emissions. Gas and oil also have the positive coefficient. Therefore, oil and gas also have positive relationship with carbon dioxide emission in Pakistan. With the rapid increase in population in Pakistan, the need for housing facilities, fuel like gas and transport facilities are increasing. These are the main factors affecting CO2 emission level. Therefore, carbon dioxide emission is also increasing. Our results and suggestions will provide further help for the policy makers to control the carbon dioxide emissions in Pakistan.

VII. POLICY RECOMMENDATIONS

The debate on factors affecting the pollution level in Pakistan is emergent importance with the passage of time. Increase in CO2 has many health problems in developing countries like Pakistan It becomes a reason for lowering the production in Pakistan. As a result, it becomes a hindrance in the development of a country. So, following measures are suggested to reduce carbon dioxide emission. Government of Pakistan should adopt more stringent policies for foreign investors while following environmental standards in true letter and spirit. Government of Pakistan should provide the incentives to foreign investors for investing in technologies which are environment friendly. Population of Pakistan is increasing with high growth. There should be a proper control on population. Family planning programs should be strengthened to control population growth rate in Pakistan.

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