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An Empirical Analysis of Energy Consumption, Environmental Emissions, and Economic Growth for Pakistan

Snober Fazal[1]

[1] PhD scholar, Department of Economics, The Islamia University of Bahawalpur, Pakistan.
Email: snoberfazal44@yahoo.com

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ABSTRACT

The use of energy plays an imperative role in the expansion of the economy so, this study examined the effect of consumption of energy and environment to economic development which derives the economic development of Pakistan's economy. This study used the famous time series ARDL methodology to empirically determine the impact of energy and environment on Pakistan economic development. Results indicates that in both short and long-run, consumption of energy and GDP level boosts economic development. While on the other hand, FDI and non-renewable-energy (fossil fuel) create hurdles in Pakistan's economic development. Due to these hurdles, increase the demand for renewable energy sources like solar and wind energy and investment in the renewable energy sector. Because it boosts economic development with the decrease in carbon emission. So, Pakistan needs to adopt these renewable energy sources which boost economic development and also mitigate the carbon emission level, which creates the environment clean and healthy.

Corresponding Author's Email: snoberfazal44@yahoo.com

1. Introduction

According to the recent years, it is studied that increased in level of pollution, climate change and destruction of environment in a growing terror. More than 190 economies attended the Paris protocol which measured the global problem of conservational issues and their effects on development in both developed and developing economies in 2015 (UNCED, 2015). The discussion remarkably indicated the affiliation among economic development and natural environment and placed sustainable development to accelerative the conception (Economic & Affairs, 2013). To moderate environment ecofriendly, this has formed more significant consciousness about environmental difficulties and improved the communication among the different countries, mostly importantly to moderate emissions of greenhouse gases as CO_2 to escape aggressive environmental variations (Okubo & Levin, 2013), if upcoming climate changes not stopped, it will cause terrible costs of growth and health of human population globally (Nhamo & Nhamo, 2016).

According to available resources, the relationship between growth and environment is different. Consequently, natural resources are the significant factor to producing the goods in the economy, while industrial and agricultural sector are prime factor to pollution and put more pressure on the environment (Tietenberg & Lewis, 2016). Deprived conservational quality, regrets of health and growth by discouraging the excellence and number of resources or due to comfort influences, etc. In this point of view, environmental instructions can limit the opposing reactions due to the economic growth in the environments. However, in what way they use as a left way of society and whether the view is useful is the subject of sufficient discussion and be dependent on the process they are planned and applied (Bergstrom & Randall, 2016).

Therefore, mostly in developing countries like Pakistan, the association among economic growth and environment is plainer nowadays as compare to the past with a fast-growing population and poverty level. Hence, for economic growth and protection of the environment, the developing economies are making struggles to achieve their targets (Lin, Omoju, & Okonkwo, 2015). As in other developing countries in Nigeria, the plans of growth based on energy incentive, economic growth, and agrarian biochemical technology, ignoring original growth model, has run to environmental destruction (Muhammad A Nawaz & Hassan, 2016; Onakoya, Onakoya, Jimi-Salami, & Odedairo, 2013).

Pakistan's economy was struggling on working to influence the nation's massive wealth in gas and oil but yet the economy's poverty figure approximately 9.9% or more than it (NBS, 2015). It is stated that rise in the level of consumption of energy has a negative influence on the environment such as consumption of energy have some effects on our environ liquid and fossil fuel use significantly damage as compared to another measure of energy, including pollution i.e. rainwater and airborne, flora and fauna, hurt to public health, global heating and environment damage (Elimelech & Phillip, 2011).

In recent times, Pakistan is one of the most developing economies in ASEAN donated with natural resources, including forthcoming energy assets. However, an increase in the demand of energy primes to boost economic progress in Pakistan. Hereafter being the use of energy is the wheels of economic evolution in Pakistan since the consumption of energy is a crucial feature of the construction of goods & services. The findings of the study reveals that interdependence among the demand for energy and economic development with a more significant coefficient (Ang, 2007; Jayanthakumaran, Verma, & Liu, 2012; Muhammad Atif Nawaz, Azam, & Bhatti, 2019; Tang, 2009).

In Pakistan's economy, energy consumption is an essential input for the manufacturing of goods & services. Besides it, relating to transforming, extracting with energy distribution gives direct economic growth as it creates opportunities for jobs. Therefore, the other sectors of the nation strengthen due to the consumption of energy which is used as input in manufacturing of goods and services. Economic growth hugely rises due to the consumption of energy in Pakistan. Additionally, cheaper and steady energy also leads to higher economic growth. Therefore, it increases revenue limits for firms of business and also increases in disposable incomes for the consumers to deliver inducements for flown the rate of economic growth (Abosedra, Shahbaz, & Sbia, 2015; Aladejare, 2014; Gbadebo & Okonkwo, 2009). Energy consumption used as a vital factor for a nation’s GDP (gross domestic product) and economic growth. This study is dependable on the environmental Kuznets curve (EKC) framework and neo-classical theories. Both theories approved that economic evolution based on the demand for energy.

Table 1
Comparison between CO_2, GDP, Energy, and Renewable Energy Consumption

Years	CO_2	GDP growth	Energy Use	Renewable Energy Consumption
1995	2.70995521	8.120261844	1041.311428	22.6994113
2000	2.879479006	4.455676031	1148.249521	21.98813771
2005	3.782970222	4.187834924	1513.470037	20.25239594
2010	4.195642184	7.513590658	1753.702595	22.65487764
2015	3.580553511	3.133896962	1460.752215	22.86307013
2016	3.580553511	3.356488872	1460.752215	21.75412045
2017	3.580553511	4.024085781	1460.752215	21.75412045
2018	3.580553511	4.129226103	1460.752215	21.75412045

This study inspects the linkage among trade openness use as a measure of economic growth, carbon dioxide productions (CO_2), consumption of energy, foreign investment (FDI), and fossil fuel consumption in case of Pakistan. This examination applies the ultimate suitable econometric technique which is auto regressive distributive lag model with granger causality and bond test. Statistical Data collected from WDI – World development indicators

(World Bank, 2020) regarding the factors of Co2 emission, GDP Growth, Energy, and consumption of Renewable energy.

Figure 1. shows the relationship of the emission of carbon dioxide (CO2) with GDP growth, overall energy consumption, and the proportion of renewable energy consumption of the period 1995-2018. Which confirms that there exists positive association among with the passage of time. Renewable energy and carbon emission level is consistent trough out the 1995 to 2018 while economic growth is fluctuating.

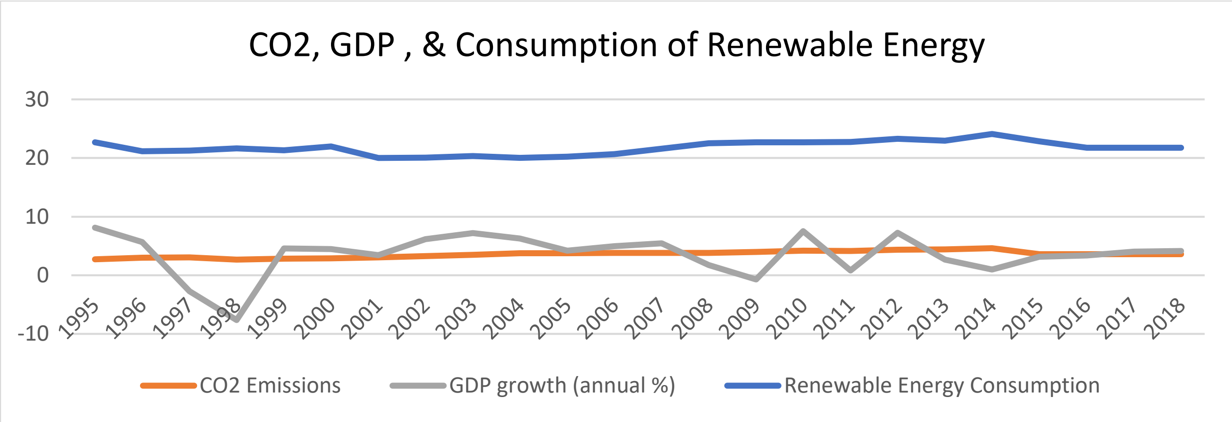

Figure 1: Time trend in CO_2, GDP, and renewable energy consumption

2. Literature Review

Grossman and Krueger (1991) claimed that economic development and environment have a significant and positive relationship. Further they concluded that trade openness plays significant role over the environmental control. Hereafter, the environment is protecting due to trade openness. Beckerman (1992) studies the robust association among the income and environment, further the protection of environment factors used to examine the long run improve in the environment is to convert rich".

Chindo, Abdulrahim, Waziri, Huong, and Ahmad (2015) inspected the connection among the GDP, carbon dioxide production and consumption of energy consumption in Nigeria. The research use ARDL econometric technique and co-integration, the finding of the study disclosed that in addition to gross domestic product, there is a long run affiliation among carbon emission and demand for energy. Therefore, carbon dioxide discharges in both the long & short-run have an increasing and significant effect on growth. In contrast, the use of energy has a harmful and significant influence on the gross domestic product in the short term. Lin et al. (2015) inspected the effect of economic development on carbon-dioxide (CO_2) productions in Nigeria Furthermore, the results presented that economic development has a significant and inverse affiliation with carbon-dioxide (CO_2) in the case of Nigeria. Ali, Law, and Zannah (2016) survey the powerful effect of growth, urbanization, trade and use of energy towards CO_2 productions by applying the ARDL (Autoregressive Distributed Lags Approach) over the time period 1971-2011, the conclusions of the study presented that consumption of energy and economic development have significantly boosted the emission of carbon. While on the other hand urbanization has no important impression to emission of carbon dioxide (CO_2). furthermore, trade openness has significant and inverse association with carbon emissions (Ejuvbekpokpo, 2014) concluded that economic development has adverse and significant impression on carbon emission level. Further it concluded that CO_2 emissions negatively effecting due to economic development.

Arouri, Youssef, M'henni, and Rault (2012) examined the affiliation between energy use in addition to gross-domestic product (GDP) and carbon dioxide production for 12 Middle East Nations and North African for the time period of 1981–2005. By employing modern bootstrap panel co-integration and unit-roots tools, the results of the study showed the long-run positive and significant association between energy consumption with carbon dioxide emissions. At the same time, gross domestic product revealed additional unusually quadratic relation with CO_2 (carbon dioxide) emissions for the nations. Khan, Khan, Zaman, Khan, and Zahoor (2013) observed the causal relationship among economic development, greenhouse emissions with consumption of energy. Using the Granger causality and cointegration in case of Pakistan, for the spam from 1975–2011. The study results disclosed that consumption of energy is an imperative determinant in carbon dioxide emissions and at the same time, unidirectional causation due to the consumption of energy to carbon dioxide emissions.

Dantama, Abdullahi, and Inuwa (2012) studied the affiliation of consumption of energy towards economic growth over the time period 1980 to 2010, the research examined the consumption of energy as a proxy of environmental degradation. Hence, the study applies the ARDL econometric technique. The results showed that their exits significant association among use of energy and economic development. Trade openness and FDI's are major components to destruction in environmental improvement. Further, there exists a bidirectional causation among foreign direct investment, economic development, and CO_2 releases (Lau, Choong, & Eng, 2014). Additionally, the studies on this context include;(Culas, 2007; Daly, 1977; DeFries, Rudel, Uriarte, & Hansen, 2010; Khan et al., 2013; Panayotou, 1994; Rudel, 2013; Zeb, Salar, Awan, Zaman, & Shahbaz, 2014).

In the end, studies on the environmental influence on economic development revealed that economic growth is hostile by the environment. However, others were with a different point of view about its concern. It is observed that by employing different time series tools, empirical researches which discussed above. In the shed of previous literature, the current study will fill the gap by providing a simple technique to explain the impact of environmental degradation on economic growth for Pakistan with the help of ARDL (Autoregressive distribute lag) model. Rest of the study consists of further 3 section, section 3 explains the data and methodology of the study, results and discussion is explained in section 4 and finally section consists on conclusion and policy recommendations.

3. Data and Methodology

According to growth theory which shows the significant affiliation among the environmental degradation and economic expansion indicators which is explained in the study (Xepapadeas, 2005), just a few studies have inspected the causal affiliation among ecological quality and development. Most studies researched the environment Kuznets curve based on economic growth and environmental degradation. Several models used with three or four variables, but this study uses five controlled variables in addition to examining their impact on economic growth (Chindo et al., 2015; Rafindadi, 2016). This study also uses the autoregressive distributive lag method for co-integration established by (Pesaran, Shin, & Smith, 2001) to assess the affiliation among CO_2 emanations, fossil fuels, energy used, opening trade and FDI for Indonesia, and the study covers the time period of 1980 to 2018.

Initially, the root unit check is still used to expose data stationarity, which can usually be set as $-1 \leq \rho \geq or\ \rho = 1/\rho/< 1$. The root unit studies based on the intercept, trend, and both trend and intercept which is verified by Dickey-Fuller (ADF) and the Philips - Perron. Therefore, the combined stochastic technique is used somewhere where mixed conditions are used $I\,(0)\ amd\ I\,(1)$ depending on the result of the root unit test. This technique has often been referred to in contemporary literature and is preferred over Johansen's co-integration technique. While ARDL's mathematical illustration techniques are used to prove the presence of a affiliation among environmental degradation and development in Indonesia. So, we changed the research model by looking at the variables as shown below;

$$GDP = f(EUSE, CO2, FFUEL, TRA, FDI) \quad (1)$$

Taking the log of the general model will become in econometrics model;

$$lnGDP = \sigma_o + \sigma_1 lnEUSE, +\sigma_2 lnCO2 + \sigma_3 lnFFUEL + \sigma_4 lnTRA + \sigma_5 lnFDI + \varepsilon_t \quad (2)$$

By equation (2), GDP means Gross Domestic Product per-capita (used as an endogenous variable and indicator of economic expansion), CO_2 symbolizes carbon dioxide emissions, EUSE indicates energy used, FFUEL represents consumption of fossil fuels. At the same time, TRA is expressed by opening trade and means FDI foreign direct investment, the next step in controlling co-integration. Now, there are different dominant methods such as the (Engle & Granger, 1987) technique that are centered persistently, the Johesn Cointegration technique of (Johansen & Juselius, 1990) plus the ARDL test established by (Pesaran et al., 2001). This review uses the Autoregressive distribution lag method to avoid hard and similar endogeneity to produce more consistent and fruitful results. In both the short and long-run estimates the equation will become like;

$$lnGDP_t = \tau_o + \sum_{i=1}^{p} \tau_1 \Delta lnGDP_{t-1} + \sum_{i=0}^{p} \tau_2 \Delta lnEUSE_{t-1} + \sum_{i=0}^{p} \tau_3 \Delta lnCO2_{t-1} + \sum_{i=0}^{p} \tau_4 \Delta lnFFUEL_{t-1} + \sum_{i=0}^{p} \tau_5 \Delta lnTRA_{t-1} + \sum_{i=0}^{p} \tau_6 \Delta lnFDI_{t-1} + \tau_7 lnGDP_{t-1} + \tau_8 lnEUSE_{t-1} + \tau_9 lnCO2_{t-1} + \tau_{10} lnFFUEL_{t-1} + \tau_{11} lnTRA_{t-1} + \tau_{12} lnFDI_{t-1} + \epsilon_t \quad (3)$$

As a result, the null hypothesis is verified by $H_o: \tau_7 = \tau_8 = \tau_9 = \tau_{10} = \tau_{11} = \tau_{12} = 0$ and $H_a: \tau_7 \neq \tau_8 \neq \tau_9 \neq \tau_{10} \neq \tau_{11} \neq \tau_{12} \neq 0$ to choose if co-integration in the long term relationship occurs. Thus, the F statistic with the lower and upper limits, $I\,(0)\ and\ I\,(1)$, systematically, initiates the denial of the null hypothesis and which means that there exists the long-run relationship within them model. If the F-stat value stays more magnificent than the lower and upper bond the test, then we accept alternative and reject the null hypothesis. While if the stat value is less than the lower and upper bound of the statistics, then we take the null and discard alternative. That means that there does-not happen the long-run connection among the model (Narayan, 2005; Pesaran & Shin, 1998; Pesaran et al., 2001). Then the research model is also needed to verify the Schwartz-Bayesian (SBC) criteria and Akaike information criteria (AIC), the error correction model (ECM) is evaluated as equation (5) below:

$$lnGDP_t = \tau_o + \sum_{i=1}^{p} \tau_1 \Delta lnGDP_{t-1} + \sum_{i=0}^{p} \tau_2 \Delta lnEUSE_{t-1} + \sum_{i=0}^{p} \tau_3 \Delta lnCO2_{t-1} + \sum_{i=0}^{p} \tau_4 \Delta lnFFUEL_{t-1} + \sum_{i=0}^{p} \tau_5 \Delta lnTRA_{t-1} + \sum_{i=0}^{p} \tau_6 \Delta lnFDI_{t-1} + \tau_7 ECT_{t-i} + \epsilon_t \quad (4)$$

Where the error correction term will be expressed as;

$$ect_{t-1} = \omega_{t-1} = lnGDP_t - (\sum_{i=1}^{p} \tau_1 \Delta lnGDP_{t-1} + \sum_{i=0}^{p} \tau_2 \Delta lnEUSE_{t-1} + \sum_{i=0}^{p} \tau_3 \Delta lnCO2_{t-1} + \sum_{i=0}^{p} \tau_4 \Delta lnFFUEL_{t-1} + \sum_{i=0}^{p} \tau_5 \Delta lnTRA_{t-1} + \sum_{i=0}^{p} \tau_6 \Delta lnFDI_{t-1}) \quad (5)$$

Where Δ is the first difference operator and ω describes the ECM term which tells the speed of adjustment of the model? There is a necessary condition for ω it is always negative besides statistically significant for the presence of long term association in the model for this purpose, first of all, we estimate the F-stat value and will make compared with calculated values and then confirmed that (Narayan, 2005). Cointegration exists when the F stat value is higher than the inferior and superior bound. Results indicates that alternative hypothesis is accepted and denial of the null hypothesis. Furthermore, if the value is less than the inferior and superior bound of the statistics results from receipt of null and refusal of the alternative hypothesis. This means that there does not exist a long-run affiliation among the model. To test cointegration, the null hypothesis is defined as $H_o: \tau_1 = \tau_2 = \tau_3 = \tau_4 = \tau_5 = \tau_6 = 0$ while the alternative premise is given as $H_a: \tau_1 \neq \tau_2 \neq \tau_3 \neq \tau_4 \neq \tau_5 \neq \tau_6 \neq 0$. While ECT_{t-i} remains be an error-correction model. The importance of error correction models shows the long-term connection among the endogenous and independent variables. Thus, the error correction model values are calculated from the estimated long-term coefficients. This study covers the time span of 38 years, from 1980 to 2018. The World Development Indicators website is used to collect data of desired indicators, which are Economic development is proxied by GDP (per capita), Environment degradation is an emission of carbon dioxide, energy used for consumption of energy, fossil fuels consumption is nonrenewable energy and through trade (exports plus imports) and investment is measured by foreign direct investment (FDI).

4. Results and Discussion

As usual, in the initial step, this study uses a unit root test that is Augment Dickey-Fuller (ADF) in addition to Phillips-Perron (PP) to test the order of stationarity amongst the indicators of interest. The results are presented in Table 2 below. As a result, the numerical values proposed and confirmed that all the indicators are not stationary at level I (0) and stationary at the first difference I (1). So, according to results, all indicators are stationary at first difference.

Table 2
Unit root tests

Tests	Augmented Dickey-Fuller (ADF)			Phillips-Perron (PP)		
Variables	**Critical**	**Calculated**	**Prob.**	**Critical**	**Calculated**	**Prob.**
CO_2	-3.5331	-2.3686	0.3892	-3.5331	-2.3686	0.3892
D(CO_2)	-3.5403	-6.2587***	0.0000	-3.5366	-7.2085***	0.0000
EUSE	-3.5443	-0.3608	0.9853	-3.5331	-0.4107	0.9835
D(EUSE)	-3.5366	-6.4518***	0.0000	-3.5366	-6.5070***	0.0000
FDI	-3.5331	-2.5604	0.2994	-3.5331	-2.7260	0.2325
D(FDI)	-3.5366	-5.7184***	0.0002	-3.5366	-5.7184***	0.0002
FFUEL	-3.5366	-0.7260	0.9634	-3.5331	-0.9076	0.9447
D(FFUEL)	-3.5366	-8.4063***	0.0000	-3.5366	-17.3134***	0.0000
GDP	-3.5366	-2.2065	0.4722	-3.5331	-2.0115	0.5765
D(GDP)	-3.5366	-4.6089**	0.0038	-3.5366	-4.6386**	0.0035
TRA	-3.5331	-2.6748	0.2521	-3.5331	-2.6327	0.2689
D(TRA)	-3.5366	-8.3525***	0.0000	-3.5366	-8.8411***	0.0000

$Note$: $***, **$ and $*$ $show$ 1%, 5% and 10% $level\ of\ significance\ respectively.$

After that, to achieve the purpose of this article, we examine the variable equations that begin with a preliminary review of the dataset with a demonstration of descriptive statistics that show the spread of data. Table 3 provides data on minimum, maximum, average, standard deviation, and asymmetry. The fact that all experimental variables show significant variation is a justification that the technique of estimating autoregressive distribution lag (ARDL) can be applied for research purposes. See Table 3 for a summary of Summary statistics.

Table 3
Summary Statistics

Variables	GDP	EUSE	CO2	FFUEL	TRA	FDI
Mean	26.8525	6.4623	12.4353	4.0740	3.9596	0.9914
Median	26.8759	6.5381	12.4815	4.1264	3.9563	1.0298
Max	27.7680	6.7844	13.3647	4.2070	4.5663	2.9161
Mini	25.9247	5.9343	11.4594	3.8173	3.6222	-2.7574
Stdev	0.5363	0.2970	0.5792	0.1212	0.1740	1.2656
Skewness	-0.0352	-0.6380	-0.1931	-0.8232	0.9552	-0.7871
Kurtosis	1.9569	1.9010	1.7831	2.2687	5.4128	3.7504
Jarque-Bera	1.7762	4.6082	2.6488	5.2737	15.3912	4.9415
Prob.	0.4114	0.0998	0.2660	0.0716	0.0005	0.0845
Observations	39	39	39	39	39	39

The next step is the analysis of the ARDL bound test. The outcomes are presented in Table 4.the The F statistics of all the variables highlighted (i.e., gross domestic product as the dependent and growth indicators and other controlled variables of the estimated F statistics are more exceptional than the critical limits of both lower and upper bounds. These results revealed that this study has cointegration among exogenous and endogenous indicators. Therefore, the presence of a long-term association among indicators during the period of 1980-2018. See Table 4 for ARDL bound tests for cointegration.

Table 4
ARDL Bond test

Statistic	Value	K
F-stat	5.610924	5
Critical Value		
Sig.	I_0 Bound	I_1 Bound
1%	3.41	4.68

The bound test value is 5.61 which is higher than the value of 1% critical lower and upper bound value which means according to the calculated value, we discard the null hypothesis & take the alternative premise. It concludes that there exists a long-run association among growth and determinants of growth used in this study. Furthermore for approximating the long and short coefficients of indictors to development used the ARDL model which is purposed by (Johansen & Juselius, 1990) test because of the multivariate methodology of (Johansen & Juselius, 1990) is a co-integration methodology well known. However, after concluding the co-integration between research variables, the short-term and long-term estimates are presented in Table 5.

Table 5
ARDL short and long-run estimates

Variables	Coefficient	Std. Error	t-Statistic	Prob.
D (EUSE)	1.1193*	0.6244	1.7925	0.0828
D (CO_2)	-0.5971**	0.2373	-2.5161	0.0173
D (TRA)	-0.7683***	0.1499	-5.1266	0.0000
D (FDI)	0.0335	0.0209	1.6030	0.1191
D (FFUEL)	-2.6058**	1.1732	-2.2211	0.0338
ECT(-1)	-0.5498***	0.0905	-6.0780	0.0000
	Long-run estimates			
EUSE	2.0357*	1.1521	1.7670	0.0871
CO_2	-1.0860**	0.3469	-3.1304	0.0038
TRA	1.3974***	0.3104	4.5021	0.0001
FDI	-0.0610*	0.0351	-1.7349	0.0927
FFUEL	-4.7393**	1.9877	-2.3843	0.0234
C	5.1875	3.4238	1.5151	0.1399

$Note$: $***,**$ and $*$ $show$ $1\%, 5\%$ and 10% $level\ of\ significance\ respectively.$

Table 5 above illustrates long-term results, revealing that the energy coefficient (EUSE) in the model has been found to have a significant and positive affiliation with economic development. These results designate that the rise in consumption of energy in Indonesia is closely associated with economic evolution in Indonesia. For example, increasing energy consumption by 1% increased economic growth by 2.0357%. This study is consistent with EKC theory and neoclassical economic theory which considers that consumption of energy as a key factor for economic development, also studies that are consistent with empirical literature such as (Apergis & Payne, 2009; Soytas & Sari, 2009).

Conversely, the flow of fossil fuels (FFUEL) and (FDI) have a negative influence on evolution (GDP) in Pakistan. Then this relationship is significantly at a 5% level. Thus, a 1% rise in FF fuel consumption and FDI will cause a decline in the economic development of -4.7393% and -0.0610%, respectively. These outcomes are reliable with the results of (Searchinger et al., 2008; Smarzynska Javorcik, 2004). The negative sign of the coefficient on foreign direct investment is similar with economic theory, where an rise in loan prices will affect investment and further reduce gross domestic product. Other variables in this model are not important to affect the Indonesian economy in the long run.

Meanwhile, according to the short-run, therefore, revealed that economic growth (GDP) is significant and positively related to consumption of energy (EUSE) at a significant level of 1% with a coefficient of 1.1193. On the other hand, at a 5% significance level, their growth in use of energy boosts in economic growth (GDP) by 1.1193%. This result is similar with the empirical outcomes of the following: (Lise & Van Montfort, 2007; Shahbaz & Lean, 2012). Although FDI is negatively related to economic growth (GDP) at the 5% significance level with a coefficient of 0.045. Furthermore, this can result from repatriating the profits of multinational companies to their respective countries for reinvestment and other forms of market power. See (Belloumi, 2014; Fedderke & Romm, 2006; Stanisic, 2015). Fossil fuels (FFUEL) has negatively associated with economic development at a significant level of 1% with a coefficient of -2.6058. Although a 1% increase in fossil fuels will have the effect of economic growth from a 2.6058% decrease in growth also in the case of Indonesia. This result is consistent with (Ocal & Aslan, 2013; Shafiee & Topal, 2008).

The ECM coefficient is negative, with a coefficient 0.5498 and is significant at 1%, and this result shows that the long-term adjustment speed is around 55%. Therefore, this shows that the rate of model converges to its equilibrium is 55% in the first year. Thus, this study initiate a short-term and long-term affiliation among variables with positive and statistically significant affiliations among the environment, consumption of energy and growth.

According to table 6, model diagnostics results are given. R-square and adjusted R-square expressed the model is a good fit because its value is 97%, which means exogenous variables explain the dependent variables are 97%. DW values are greater than 1.65 which means the model is valid, LM and Breusch Pagan test is greater than 5%. This means accepting the null hypothesis which means there does not exist auto and hetero problem in the regression model. Hence conclude that the model is the best fit; it passed all the diagnostics tests.

Table 6
Model Diagnostics

R^2	0.979001
Adj. R^2	0.974937
D W	1.803855
LM	0.3932
Breusch-Pagan-Godfrey	0.4204
Normality	0.6322

For the model stability, there used the CUSM and CUSUM square tests used and which are shown in fig. 1 and 2. Furthermore, the graphs explain that the estimated line is in amid the two standard deviation lines which confirms that the model is statistically stable at %5 significant level.

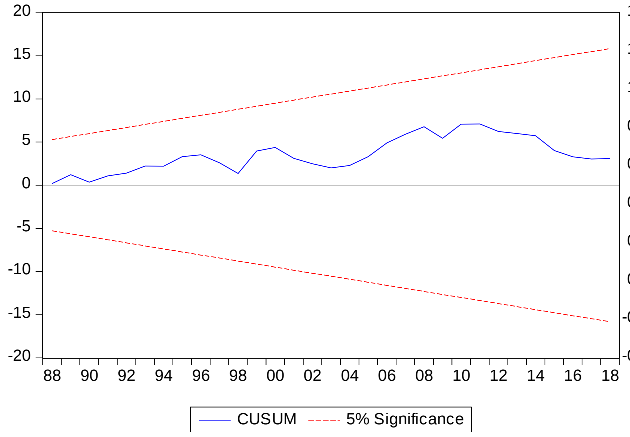

Figure 2: CUSUM stability test

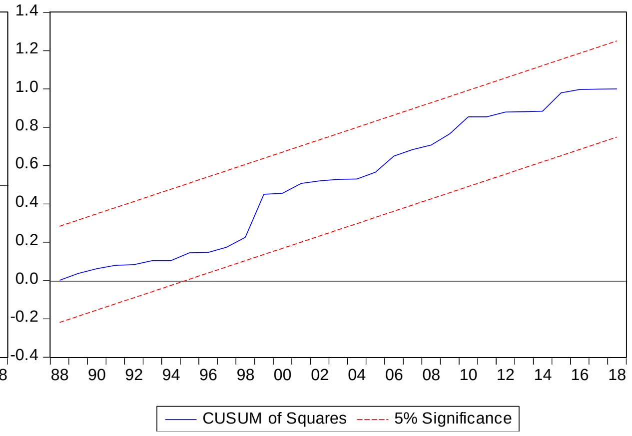

Figure 3: CUSUMSQ stability test

5. Conclusion & Recommendations

This study inspected the influence of usages of energy besides outcome of environment on the economic development in the Indonesia for the period of 1980 to 2018. To empirically estimate the impression of energy and environment to growth they applied the ARDL methodology which is derived by (Pesaran et al., 2001). Empirically results established that rise in the use of energy boosts the level of economic expansion which is confirmed in short and also in the long run estimates. While Indonesia is also linked with that nation which has strong economic development which can be clarified by the Indonesian gross domestic product. Results further clarifies that a growth in energy usage by 1% rises growth by 6% while fossil fuels and FDI, net inflows have a adverse influence on GDP in Indonesia, so this relationship is statistically significant at 1% each. However, a short-term analysis reveals that growth is still positively related to energy consumption at a significant level of 1% and the coefficient is 1.347, which means that a growth of 1% energy consumption will translate to an increase in growth of 1,347%. While FDI is negatively associated with GDP at the 5% importance level and the coefficient of 0.045% means that an rise of 5% of GDP will cause a decrease to - 0.045% of FDI, and fossil fuels are negatively associated with development at a significant level of 1% and the coefficient of -0. 340.

An increase of 1% growth will decrease by -0.340% in the consumption of fossil fuels. Like other studies, this study is consistent with most publications focusing on one or a group of countries (Halicioglu, 2009; Lise & Van Montfort, 2007; Soytas & Sari, 2009). This study reviewing the impression of use of energy towards economic progress, the main results of this research show that the industrialization process is the main reason of the high level of economic expansion in Indonesia through, it will produce more carbon dioxide emissions and be harmful to the environment.

Going forward, these results should be an overlay of tools to guide the top choices for reducing the prevalence of carbon dioxide emissions by improving industrial processes and production, as factors that are measured strongly to protect the physical environment in Indonesia which are on the path to economic transformation. With this in mind, the following recommendations are made with regard to the environment and economic growth in Indonesia. Policies designed to protect our environment by reducing pollution and deforestation during industrialization and production or mining processes in Indonesia must expand economic activities, take important steps to provide a healthy environment and build a movement towards enlightened communities about the importance of healthy ecosystems. The Indonesian government must undoubtedly have to impose sanctions that apply to pollutants and other emitters that refuse to reduce the reductions allowed for businesses or individuals.

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