“An analysis of foreign aid and environmental degradation in Pakistan using the ARDL bounds testing technique (1972-2013)”

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ARTICLE INFO	Abida Yousaf, Himayatullah Khan, Naila Erum and Saira Rasul (2016). An analysis of foreign aid and environmental degradation in Pakistan using the ARDL bounds testing technique (1972-2013). *Environmental Economics*, *7*(1), 16-23. doi: 10.21511/ee.07(1).2016.02
DOI	http://dx.doi.org/10.21511/ee.07(1).2016.02
RELEASED ON	Thursday, 24 March 2016
JOURNAL	"Environmental Economics"
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
0	0	0

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Abstract

The paper examines the relationship among foreign aid, per capita GDP, energy consumption, foreign direct investment and carbon emissions in Pakistan. Autoregressive distributed lag (ARDL) bounds testing technique is used for empirically testing using annual data from 1972 to 2013. The study uses carbon dioxide emission (CO_2) as an indicator of environment quality. The two components of foreign aid (foreign loans and foreign grants) are used to measure the environmental impact of foreign assistance in Pakistan. The study finds that energy consumption, per capita GDP and FDI contribute positively to raise the carbon emissions in the country. Furthermore, foreign loans and grants are also found significant contributors to the degradation of environmental quality in case of Pakistan. Similarly, the short run results of the model indicate that the signs of the coefficients are consistent with the long run estimates. On the basis of its findings, the study suggests that effective policies be followed for reducing (CO_2) emissions along with regulating FDI-environment and per capita GDP-environment relationship.

Keywords: foreign aid, environment, energy, pollution, Pakistan.
JEL Classification: F35, F64, Q53, Q13.

Introduction

Sustainable economic development cannot be achieved without environmental protection because sustainable development involves economic growth, social equity and environmental sustainability. In 1972, during the first international conference on the environment in Stockholm, policymakers and environmentalist broadly identify exploitation of natural resources, carbon emissions, and extinction of biodiversity by developing countries. But, developing countries do not have sufficient financial resources to prevent such damages to the environment. The developing countries consistently pointed out that they do not have funds to allocate for the protection of the environment. They also argue that developed nations achieved development through the exploitation of the natural resources and damaged the environmental quality largely but they have not invested for the protection of the environment until they got sufficient industrialization. The articles 2 and 12 of the Stockholm Declaration state that additional financial and technical assistance should be provided to the developing countries for the protection of the environmental quality.

During the Rio Earth summit in 1992, developed nations like the United States, the members of the European Community, Canada and Japan announced that they will increase the financial assistance over the next five years. After this announcement many developing countries show their concern that such grants should not reduce the foreign aid aimed for the improvement of basic human needs and economic development. In 2005, the leaders of the G8 group countries met at the Gleneagles Golf Resort in Scotland to address the global environmental issues. All members agreed to provide financial assistance and access to the clean energy technologies to the developing countries for the protection of the environment. Overtime, many efforts have been observed for the protection of the environment.

In this paper we have analyzed the environmental impact of foreign aid in Pakistan. Like many other developing countries, Pakistan is also confronted with the shortage of financial resources and meets it through borrowing from internal and external resources. Since independence, Pakistan has resorted to borrow foreign loans and grants for its development needs. In November 1947, the US approved military aid worth of $10 million against the Pakistan's request of $170 million. During 1950s, Pakistan has also started to receive loans under the Colombo plan (Hasan, 1999). Till 1966, Pakistan received $5 billion from the US in the form of loans. At that time, the growth oriented government of Pakistan realized that in order to compete with the faster growing population (3 percent per annum) the required growth rate is 6 percent but the saving-investment gap was a major constraint to achieve such a high growth rate continuously. Ultimately, the government relied upon the foreign loans and grants to fill this gap. From 1971-1975 to 1991-1995, foreign loans and grants (current US$) showed an increasing trend in Pakistan but started declining from 1996-2000 to 2002-2003. The rising

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trend in the foreign loans and grants can be observed again from 2004 to 2012. Overall, foreign loans and grants have increased in Pakistan from 1972 to 2013 accompanied with few periods showing swift decline in the foreign loans and grants (see Table 1). Pakistan has received $30.72 billion of external loan during 2004 to 2014[1]. Similarly, gross domestic product (GDP) per capita is also showing an increasing trend overtime which may be considered as an indicator of the overall growth of the economy. But, along with this growth carbon dioxide (CO_2) emissions per capita have also increased overtime which is a negative externality for the environment (see Table 1).

Table 1. Trends in foreign loan, foreign grants, GDPPC, and carbon emission (1971-2013)

Year	Foreign loans (million US$)	Foreign grants (million US$)	GDP per capita (million US$)	CO_2 emissions (metric tons per capita)
1971-1975	77.75	191.5	144.094	0.332
1976-1980	865.4	676.6	237.478	0.355
1981-1985	896.8	1516	338.206	0.455
1986-1990	1542.4	2135	351.051	0.554
1991-1995	2213.4	1450.2	427.866	0.644
1996-2000	1991.2	908.6	473.940	0.720
2001	1903	1002	492.382	0.737
2002	1800	401	483.032	0.762
2003	1283	335	546.154	0.780
2004	2073	506	631.498	0.848
2005	2159	1068	693.177	0.865
2006	2675	681	853.071	0.908
2007	2586	574	929.587	0.969
2008	7357	575	1018.381	0.953
2009	5248	737	986.954	0.942
2010	1925	676	1023.196	0.940
2011	4286.9	805.4	1212.419	0.928
2012	1277.6	1382.3	1252.420	0.956
2013	6840	447.9	1275.302	-

Source: Pakistan economic survey (various issues) and WDI's, World Bank.

Among other factors, FDI and energy consumption are also significant drivers of environmental damage in Pakistan. The FDI-environment relationship can be well explained through the pollution haven hypothesis. The hypothesis states that developing countries try to attract FDI and purposely underestimate the environmental damages. Thus, due to less stringent environmental laws foreign investors move their production base to the developing countries. Whereas, pollution halo hypothesis argues that FDI not only helps to transfer cleaner technologies to the developing countries but it also enables the producers to use less pollutant technologies for the production purposes. It is also documented by various studies that use of oil, coal and other energy sources in production and transportation systems leads to degrade environment by emitting CO_2 (Grossman and Kruger, 1991; and Antweiler et al., 2001). Due to environmental degradation Pakistan is bearing the financial loss of $5.2 billion per year[2]. Therefore, it is important to empirically estimate the environmental impact of foreign aid, GDP per capita, FDI and energy consumption in case of Pakistan for formulating appropriate economic policies for securing our environment from the ill-effects of the foreign aid, grants and FDI.

Section 1 presents literature review on the empirical nexus between the foreign aid and the environment, Section 2 describes the theoretical framework with data and econometric methodology used in the study, empirical results and discussion are illustrated in Section 3 of the study, and the Final Section concludes the study with some policy recommendations.

1. Literature review

The foreign aid literature is particularly devoted to evaluating the effect of aid on the economic growth. For example Papanek (1973), Dowling and Hiemenz (1982), Gupta and Islam (1983), Boone (1996), Hansen and Tarp (2000), Alesina and Dollar (2000), Gounder (2001), Lloyd et al. (2001), Pallage and Robe (2001), Hansen and Tarp (2001), Easterly (2003), Gomanee et al. (2003), Dalgaard et al. (2004), and Karras (2006) indicate that foreign aid has positive effect on economic growth. Whereas, Cassen (1994), Svensson (1999), Burnside and Dollar (2000) and Brautigam and Knack (2004) show that foreign aid

[1] Statistics issued by the "Senate Standing Committee on Finance, Revenue and Economic Affairs (August 6, 2015)".
[2] For more details see, Environment Bulletin (2014).

and economic growth are negatively related with each other. These studies have not discussed the impact of foreign aid on environmental quality.

Arvin et al. (2006) examine the nature of relationship between foreign aid and the environment in case of developing countries covering the time period from 1960 to 1999. The Granger causality test results indicate that bidirectional relationship exists between the carbon emissions per capita and foreign debt per capita in case of both low income and high income countries. Though, the sign of causality is positive for high income countries and negative for low income countries. It suggests that foreign aid reduces the carbon emissions in case of low income countries and increases the carbon emissions for high income economies. The study concluded that the nature of relationship between foreign aid per capita and carbon emissions per capita is conditional upon the level of external debt of an economy. Recently, Sahoo and Sethi (2014) analyze the impact of foreign aid, GDP, forest depletion and trade liberalization on the environmental quality in case of India. The study used OLS estimation technique and the study covers the time period from 1970 to 2011. Findings of the study indicate that foreign aid is statistically and negatively related with the environmental degradation. It means that foreign aid can be helpful in improving the quality of environment in India. Whereas, GDP, forest depletion and trade liberalization positively contribute to the degradation of the environmental quality.

Lim et al. (2014) test the hypotheses that foreign aid positively affects the environmental quality when the recipient country is less dependent on the globalization flow from the north and negatively affect the environment when the recipient country has high economic dependence on the globalization flow from the north. The authors have used SO_2 as a measure of environmental quality and FDI and exports are used as a measure of globalization flows. The findings of the study support the validity of both hypotheses which means that foreign aid reduces the pollution in countries with no globalization flows and increases the pollution in countries which are more dependent on the globalization flows[3].

In case of Pakistan, there is lack of empirical literature on the nexus between foreign aid and the environment. Most of the researchers analyze the impact of foreign aid on the economic growth of the country. For example, Khan and Ahmed (2007) find that dependence on the stable and sustainable external resources could be helpful in enhancing economic growth in Pakistan. Whereas, Khan and Rahim (1993), Khan (1997), Ishfaq and Eatzaz (2005), Javid and Qayyum (2011) reported negative relationship between foreign aid and the economic growth. This deteriorating effect of foreign aid on the economic growth is associated with the ineffectiveness of macroeconomic policies, misutilization of foreign aid and economic instability in the country. In this study an attempt has been made to investigate the empirical nexus between the foreign aid and the environmental quality and its implications for Pakistan. Thus, this study is pioneer in investigating the foreign aid-environment nexus in case of Pakistan.

2. Analytical framework

To model the effect of foreign aid, FDI, per capita income and energy consumption on carbon emissions, we use the following functional relationship.

$$CO_2 = f(GDP, FRA, FDI, EC). \quad (1)$$

Where CO_2 represents Carbon dioxide emissions measured in metric tons, used as a proxy for the environmental degradation. The foreign aid has two components including foreign loans (*FRL*) and foreign grants (*GR*) which are used to measure the environmental impact of foreign assistance in Pakistan. The rationale behind using foreign loans and grants is that governments usually use foreign loans and grants for their development and capital expenditures which can significantly affect environmental quality. FDI is foreign direct investment measured in its net inflows. GDP represents real GDP per capita, and EC represents fossil fuel energy consumption (as a percentage of total energy consumption). In order to test the relationship conceptualized above, the empirical model can be written as follows:

$$LCO_{2,t} = \beta_0 + \beta_1 LGDP_t + \beta_2 LFRL_t + \\ + \beta_3 LGR_t + \beta_4 LFDI_t + \beta_5 LEC_t + \mu_t. \quad (2)$$

We have selected all these variables on the basis of relevant theoretical and empirical literature available on the impact of foreign aid on the environmental quality. All variables used in this study are in natural log form. The GDP per capita has been included in the model to test the impact of growth on the environment. The coefficient of growth (β_1) can be positive or negative depending on the nature of growth (Shahbaz and Leitao, 2013). The impact of aid and grants on the environment can be positive or negative depending upon the priorities and commitments of the donors and the recipient countries. Usually, developing countries like Pakistan give less importance to the environmental protection and safety as compared to other developmental objectives like growth, investment and economic stability. We expect the signs of the foreign

[3] FDI more than 7% of GDP increases pollution (Lim et al., 2014).

aid and grants coefficients (β_2, β_3) to be positive (Trap, 2000). The signs would be negative if the donors and the recipient countries are committed to improve the environmental quality through different laws and protections schemes. The justification for incorporating FDI in this model is that with increase in foreign direct investment, the environmental degradation also increases. As economic theory asserts that beyond a certain level FDI lowers CO_2 emissions as multinational corporations (MNCs) adopt new production technologies to enhance output with less emissions. Hence, the expected sign for β_4 is negative. Contrary to this, the sign would be positive if environmental laws are less stringent in a country because in such a situation MNCs enhance their production at the cost of environment (Pao and Tsai, 2011). Finally, the coefficient of energy consumption (β_5 is expected to be positive because throughout the world energy used for the provision of electricity, transportation, refrigerators, cooling and air conditioning constitute 40 percent of the total energy consumed (Omer, 2009). All the required data have been sourced from Pakistan Economic Surveys and World Development Indicators (WDIs), of the World Bank. The study covers the time period from 1972 to 2013.

2.1. The econometric model. There are number of univariate and multivariate cointegration techniques available to investigate the long run relationship among the time series variables. The univariate estimation techniques include the Engle and Ganger (1987) approach, the fully modified ordinary least square (OLS) cointegration technique of Phillips and Hansen (1990) and the autoregressive distributive lag (ARDL) Model (Pesaran et al., 2001). Whereas, the multivariate techniques are Johansen (1988) and Johansen and Juselius (1990) cointegration techniques and the full information maximum likelihood method of estimation (Johansen, 1996). This study employs the ARDL bounds testing approach to cointegration. This approach is preferable over the previous presented approaches of cointegration due to number of reasons. Firstly, it is easy to run even in case of small sample size and provide unbiased results (Pesaran and Shin, 1999). This is one of the main reasons for employing this technique in this study. Secondly, this technique provides consistent results irrespective of the fact that variables are integrated of $I(0)$ or $I(1)$ (Pesaran and Pesaran, 1997). However, the shortcoming of this approach is that it collapses if the series are integrated of $I(2)$. Finally, the ARDL bound testing approach to cointegration can differentiate among dependent and independent variables (Narayan, 2004). The ARDL framework of equation (2) is as follows:

$$\Delta LCO_{2t} = \alpha_0 + \alpha_1 T + \sum_{i=1}^{p} \beta_i \ln CO_{2,t-i} + \sum_{i=0}^{q} \delta_i \ln GDP_{t-i} + \sum_{i=0}^{r} \varepsilon_i \ln FRL_{t-i} + \sum_{i=0}^{s} \sigma_i \ln GR_{t-i} + \sum_{i=0}^{t} \omega_i \ln FDI_{t-i} +$$
$$+ \sum_{i=0}^{u} \gamma_i EC_{t-i} + \lambda_{CO_{2,t}} \ln CO_{2,t} + \lambda_{GDP} \ln GDP_t + \lambda_{FRA} FRL_t + \lambda_{GR} GR_t + \lambda_{FDI} \ln FDI_t + \lambda_{EC} \ln EC_t + \mu_t. \quad (3)$$

Equation (3) provides both the short run and the long run estimates, simultaneously. The summation terms represent the error correction dynamics i.e. α_i, β_i, δ_i, ε_i, σ_i, ω_i and γ_i. While, the second part (λ's) shows the long run relationship. The null hypothesis of no cointegration i.e. $H_0 = \lambda_{CO_2} = \lambda_{GDP} = \lambda_{FRA} = \lambda_{GR} = \lambda_{FDI} = \lambda_{EC} = 0$ is tested against the alternative i.e. $H_1 = \lambda_{CO_2} \neq \lambda_{GDP} \neq \lambda_{FRA} \neq \lambda_{GR} \neq \lambda_{FDI} \neq \lambda_{EC} \neq 0$ by using the F-statistic value. Pesaran et al. (1996) formulated two sets of appropriate critical values. The lower critical bound value assumes that all variables are $I(0)$ and the upper critical bound value assumes that all variables are integrated of order one $I(1)$. The region between the upper and lower critical values is called inconclusive region. If the F-statistics lies below the lower bound values then we do not reject the null hypothesis of no cointegration among the variables. However, if the F-statistics lies above the upper bound critical values it means that cointegration does exist and we reject the null of no cointegration. On the other hand, if the F-statistics value falls in the region between the upper and the lower bound critical values then the decision regarding the existence of cointegration relationship among variables remain inconclusive. If the long run relationship exists among variables then we move to the estimation of the error correction model (ECM). ECM shows the speed of adjustment required to restore the long run equilibrium after a short term shock/disturbance.

3. Empirical results and discussion

Before applying the ARDL bound testing technique it is important to test the order of integration of all variables. Although, the ARDL technique does not require the pre-testing of the order of integration of the variables but in the presence of $I(2)$ ARDL yield spurious results. In order to examine the stationarity property of the time series we have employed Dicky-Fuller-GLS unit root test. The results of the DF-GLS unit root test are reported in Table 2. Results reveal that all variables except FDI are non-stationary at level but they became stationary at first difference. Thus, the mix order of integration implies that we can apply the ARDL technique.

Table 2. Dicky-Fuller-GLS unit root test (1972-2013)

Variables	Level	First difference	1%	5%	10%	Decision	Order of Integration
LCO_2	-1.242	-8.260	-3.770	-3.190	-2.890	Stationary at first difference	I(1)
LGPC	-2.827	-6.471	-3.770	-3.190	-2.890	Stationary at first difference	I(1)
LFDI	2.793	-	-3.770	-3.190	-2.890	Stationary at level	I(0)
LFRL	-2.759	-8.363	-3.770	-3.190	-2.890	Stationary at first difference	I(1)
LGR	-2.026	-8.126	-3.770	-3.190	-2.890	Stationary at first difference	I(1)
LEC	-1.829	-5.912	-3.770	-3.190	-2.890	Stationary at first difference	I(1)

After checking the stationarity property of the time series, we have applied the F-test to check the existence of the long run relationship among all variables of model (2). The cointegration test results are reported in the Table 3. Akaike information criterion (AIC) and the Schwartz Bayesian criterion (SBC) are two commonly used criteria for the lag order selection of the variables. In this study we have followed the SBC for the lag selection because SBC selects the minimum possible lag length (Pesaran and Smith, 1998). Results of the F-test are reported in Table 3. When each variable is taken as dependent variable one by one and after comparing the value of *F*-statistic with critical bound values we find that there exists only one cointegrating vector among all variables (see Table 3)[4]. When LCO_2 is taken as dependent variable we see that the computed *F*-statistic exceeds its upper critical bounds value. Hence, we reject the null hypothesis that there is no cointegration between LCO_2 and explanatory variables of the study[5]. We therefore conclude that there exists the long run equilibrium relationship between CO_2 and regressors given in equation (2). On the other hand, when *LGPC*, *LFRL*, *LGR* and *LEC* are taken as dependent variables one by one and regression is run we find no cointegration because in all cases the computed value of *F*-statistic is less than their respective lower bound values (see Table 3).

Table 3. Cointegration test results (1972-2013)

Specification No.	Lag	*F*-statistic	Decision
LCO_2	1	5.3164*	Cointegration exists
LGPC	0	2.9528	No Cointegration
LFRL	0	1.9827	No Cointegration
LGR	0	2.4893	No Cointegration
LEC	0	1.6633	No Cointegration

Some important diagnostic tests are reported in the last columns of the Table 4. On the basis of the P-values of the diagnostic tests we can conclude that there is no problem of normality, heteroskedasticity, and the serial correlation in the model. Furthermore, the functional form test based on the Ramsey's RESET tests hows that the model is correctly specified. After performing these tests we move to the long run and the short run estimates of the model. The long run estimates of the model (2) are reported in Table 4. The ARDL estimates reveal that the per capita GDP has positive relationship with the carbon emissions. The coefficient of the per capita GDP is statistically significant and its value is 0.042 showing that one percent increase (decrease) in per capita GDP will result in 0.042 percent increase (decrease) in carbon emissions. This finding is consistent with the results of Loi (2008), Jalil and Mahmud (2009), Hossain (2012), Lau et al. (2013) and Bukhari (2014) that the per capita GDP is positively related with the carbon emissions which leads to environmental degradation. Similarly, there is also positive and statistically significant relationship between the FDI and carbon emissions. This positive nexus between FDI and carbon emissions shows the consistency of the pollution haven hypothesis with Pakistan's data. One percent increase (decrease) in FDI would lead to increase (decrease) carbon emissions by 0.365 percent. It indicates that FDIs would increase the carbon emissions in the host nations (Copeland and Taylor, 1994; Mani and Wheeler, 1998; and Suri and Chapman, 1998). In other words, developing countries like Pakistan provide a pollution haven to the foreign investors due to less stringent environment laws.

Table 4. Long-run estimates of the model

Dependent variable: LCO_2		
Regressors	Coefficient	T-statistic [Prob]
LGPC	0.0421**	2.225[.025]
LFDI	0.365**	2.049[.049]

[4] We have repeated this procedure for all variables given in equation (2) one by one except the variable FDI because it is *I*(0) and we know that when a dependent variable is *I*(0) we can't apply ARDL technique.
[5] H_o: No cointegration.

Table 4 (cont.). Long-run estimates of the model

Dependent variable: LCO_2		
Regressors	Coefficient	T-statistic [Prob]
LFRL	0.458 ***	5.247[.000]
LGR	0.152**	2.084[.043]
LEC	0.051*	1.894[.067]
C	0.681	0.218[.829]
Diagnostic test statistic [*p*-values]		
X^2 (serial correlation)	1.6311[.202]	
X^2 (Functional form)	0.85715[.355]	
X^2 (Normality)	0.64991[.723]	
X^2 (Heterosecdasticity)	0.032467[.857]	

Note:* significant at 10%; ** significant at 5% ;***significant at 1%.

The estimate of foreign loans (LFRL) is 0.458, which indicates that foreign loans are significant contributor to the environmental degradation. Similarly, foreign grants also proved a significant determinant of carbon emissions in Pakistan. With one percent increase (decrease) in grants, carbon emissions will increase (decrease) 0.152 percent. One possible reason for this deteriorating effect of foreign loans and grants on the environment could be the inefficient and non-developmental utilization of the foreign aid. When foreign assistance comes in any country then government decides to utilize it as a combination of public goods and private goods. But usually the public goods can benefit the environment more because of government power to implement stringent environmental laws. Thus, the conversion rate from foreign aid to government public goods provisions is the key determinant of foreign aid's environmental impact (Lopez and Palacios, 2010; Lopez, Galinato and Islam, 2011; Halkos and Paizanos, 2012). Similarly, the commitment of the recipient country also plays an important role in determining the impact of foreign loans and grants on the environment quality. Developing countries like Pakistan consider foreign loans and grants as a main source for their revenue generation and due to lack of financial resources these countries use foreign assistance mainly for the fulfillment of the basic needs and covering the budget deficit rather than utilizing it for the protection of the environment or environment friendly developmental projects. Finally, empirical evidence indicates that energy consumption leads to increase carbon emissions. With one percent increase (decrease) in energy consumption the carbon emissions will increase (decrease) by 0.051 percent. This result is consistent with the findings of Chandran and Tang (2009), Jalil and Mahmud (2009), Shahbaz et al. (2010), Ahmed and Long (2012), Hossain (2012), lslam and Muhammad (2012), and Arouri et al. (2014).

The short run estimates of the model are reported in Table 5. Results indicate that all variables are statistically significant and contribute positively to the carbon emission in the short run. Hence, we can infer that the short run estimates of the model are consistence with their long run counterpart coefficients. However, the short run coefficients are quantitatively smaller than the long run coefficients (see Table 4 and 5). This implies that the LFDI, LGPC, LFRL, LGR and LEC have more adverse impact on the environment in the long run as compared to the short run. Similarly, the sign of the ECT(-1) is negative and statistically significant which shows that the external shock is temporary and about 6 percent disequilibrium in the previous year of CO_2 emissions is corrected in the current year.

Table 5. Short-run estimates of the model

Dependent variable: ΔLCO_2		
Regressors	Coefficient	T-statistic [Prob]
$\Delta LGPC$	0.059	2.572[.019]
$\Delta LFDI$	0.024	2.419[.021]
$\Delta LFRL$	0.029	1.898[.067]
ΔLGR	0.021	2.294[.028]
ΔLEC	0.046	3.777[.000]
ECM (-1)	-0.064	-1.871[.070]
Diagnostic test statistic [*p*-values]		
R^2	0.852	
Adjusted R^2	0.835	
F-statistic	2.0529[.086]	

Note:* significant at 10%; ** significant at 5%; *** significant at 1%.

Conclusions and policy implications

There is hot debate regarding the sustainability of the environment and growth. The present study attempts to investigate to what extent environmental quality in Pakistan is affected by the foreign aid along with per capita GDP, FDI and energy consumption. Loans and grants are used as a proxy of foreign aid. The study has accomplished its task covering the time period from 1972 to 2013 using the ARDL bound testing technique. The findings of the study reveal both loans and grants appeared statistically significant and positively affect the environment quality. Similarly, LGPC, LFDI and energy consumption have also been proved to be significant determinant of inflation in the country.

Policy implications of the study are straight forward. *Firstly*, the findings that the loans and grants are significant contributors to the carbon emissions suggest that strong domestic environment institutions are required for discouraging the environment unfriendly projects in the country. Similarly, this is also the responsibility of the government to explore alternative sources to finance their expenditures rather than relying upon foreign aid. On the other hand, the donors should ask the recipient country to show their commitments for the improvement of the environment quality before the disbursement of the loans and grants. Secondly, the positive association between per capita GDP and carbon emission requires that the government and the policy makers should form and adopt green growth strategies rather than just focusing on the growth oriented policies. Thirdly, the coexistence of positive relationship between FDI and CO_2 indicate that government should introduce effective policies to regulate FDI and environment nexus through reduction of carbon emissions. This can be done though the imposition of tariffs on the import of pollutant material. Finally, the finding that fossils fuels energy consumption is a significant determinant of the carbon emissions in Pakistan suggests that the policy makers should focus on the organized plan to shrink energy waste and application of energy savings projects, efficiency replacement programs, setting up efficient transformers and use of solar and wind energy.

References

1. Ahmed, K. and Long, W. (2012). Environmental Kuznets Curve and Pakistan: An Empirical Analysis, *Procedia Economics and Finance*, 1(1), pp. 4-13.
2. Arouri, M., Shahbaz, M., Onchang, R., Islam, F. and Teulon, F. (2014). Environmental Kuznets Curve in Thailand: Cointegration and Causality Analysis, IPAG Business School, France, Working Paper No. 2012 (204).
3. Arvin, M., Dabir-Alai, P. and Lew, B. (2006). Does foreign aid affect the environment in developing economies? *Journal of Economic Development*, 63 (31).
4. Cassen, R. (1994). *Does Aid Work? Report to an Intergovernmental Task Force*, Oxford: Carlendron Press.
5. Chandran, V.G.R and Tang, C.F. (2013). The Impacts of Transport Energy Consumption, Foreign Direct Investment and Income on CO_2 Emissions in ASEAN-5 Economies, *Renewable and Sustainable Energy Reviews*, 24 (2), pp. 445-453.
6. Easterly, W. (2003). Can Foreign Aid Buy Growth? *Journal of Economic Perspectives*, 17 (3), pp. 23-48.
7. Engle, R. and C. Granger. (1987). Cointegration and Error-Correction: Representation, Estimation and Testing, *Econometrica*, 55, pp. 251-276.
8. Government of Pakistan. (2011). *Statistical Supplement: Economic Survey of Pakistan*, Economic Affairs Divison. Ministry of Finance, Islamabad. Pakistan.
9. Government of Pakistan. (2012). *Statistical Supplement: Economic Survey of Pakistan*, Economic Affairs Divison. Ministry of Finance, Islamabad. Pakistan.
10. Government of Pakistan. (2013). *Statistical Supplement: Economic Survey of Pakistan*, Economic Affairs Divison. Ministry of Finance, Islamabad. Pakistan.
11. Grossman, G.M. and Krueger, A.B. (1995). Economic Growth and the Environment, *The Quarterly Journal of Economics*, 110 (2), pp. 353-77.
12. Hansen, H. and Tarp, F. (2001). Aid and Growth Regressions, *Journal of Development Economics*, 64, pp. 547-70.
13. Hasan, Said. (1999). *Pakistan: The Story Behind its Economic Development*, The Farogh-i-Islam Foundation. Rawalpindi.
14. Hossain, S. (2012). An Econometric Analysis for CO_2 Emissions, Energy Consumption, Economic Growth, Foreign Trade and Urbanization of Japan, *Low Carbon Economy*, 33(4), pp. 92-105.
15. Islam, F. and Shahbaz, M. (2012). *Is There an Environmental Kuznets Curve for Bangladesh?* Utah Valley University, Working Paper No. (38490), COMSATS Institute of Information. Lahore. Pakistan.
16. Jalil, A. and Mahmud, S.F. (2009). Environment Kuznets Curve for CO_2 Emissions: a Cointegration Analysis, *Energy Policy*, 37 (12), pp. 5167-72
17. Khan, A.H.L. Hasan and A. Malik. (1992). Dependency Ratio, Foreign Capital Inflow and the Rate of Savings in Pakistan, *Pakistan Development Review*, 3 (4), pp. 843-56.
18. Khan, M. Arshad, and Ahmed, A. (2007). Foreign Aid-Blessing or Curse: Evidence from Pakistan, *The Pakistan Development Review*, 46 (3), pp. 215-240.

19. Khan, M. Arshad and Ahmed, A. (2007). Foreign Aid-Blessing or Curse: Evidence from Pakistan, *The Pakistan Development Review*, 46 (3), pp. 215-240.
20. Khan, N.Z. and E. Rahim. (1993). Foreign Aid, Domestic Savings and Economic Growth Pakistan: 1960-1988, *Pakistan Development Review*, 32 (4), pp. 1157-67.
21. Khan, Omar Asghar. (1993). The Impact of Foreign Aid on Economic Development, In Viqar Ahmad and Rashid Amjad, *The Management of Pakistan's Economy* (1947-82), Karachi: Oxford University Press.
22. Lim, S., Menaldo, V. and Prakash, A. (2014). Foreign Aid, Economic Globalization and Pollution, *Policy Science*, *Springer*, 48 (2), pp. 181-205.
23. Lopez, R. and Amparo, P. (2010). Have Government Spending and Energy Tax Policies Contributed to make Europe Environmentally Cleaner? WorkingPapers No. 94795, University of Maryland, United States.
24. Pao, H.T. and Tsai, C.M. (2011). Multivariate Granger Causality between CO_2 Emissions, Energy Consumption, FDI and GDP: Evidence from a Panel of BRIC Countries, *Energy Economics*, 36 (1), pp. 685-93.
25. Pesaran, M.H. and Shin, Y. (1999). An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis, *Econometrics and Economic Theory in the 20th Century: The Ragner Frisch Centennial Symposium*, Cambridge, Cambridge University Press. United Kingdom.
26. Pesaran, M.H., Shin, Y. and Smith, R.J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships, *Journal of Applied Econometrics*, 16 (3), pp. 289-326.
27. Shahbaz, M. and Leitao, N.C. (2013). Portuguese Carbon Dioxide Emissions and Economic Growth: A Time Series Analysis, *Bulletin of Energy Economics*, 1 (1), pp. 1-7.
28. Svensson, J. (1999). Aid, Growth and Democracy, *Economics and Politics*, 11 (3), pp. 275-297.
29. Svensson, Jakob. (2000). Foreign aid and rent-seeking, *Journal of International Economics*, 51 (2), pp. 437-461.
30. United Nations Conference on Environment and Development (UNCED). (1992). *The Rio Declaration on Environment and Development.* Rio de Janeiro. Section 4. Chapter 33.
31. World Bank. (2013). *World Development Indicators*, Washington, DC: World Bank.