Fiscal Spending and Carbon Emissions: Evidence From Pakistan

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Abstract

This study aims to empirically investigate the role of government in the growth-environment relationship. In this regard, the study estimates the direct impact of fiscal spending and economic growth on the environment. Since fiscal spending also affects economic growth, which further affects the environment, therefore, our second objective is to capture this indirect impact of fiscal spending on the environment through economic growth. To fulfill our objectives, we use carbon emissions as a proxy for environmental degradation, and government consumption expenditures to measure fiscal spending. We have utilized time series data ranging from 1960-2013 and employ Fully Modified Ordinary Least Square estimation technique to estimate the direct and indirect impact of government spending on environmental degradation. Our findings confirm the existence of environmental Kuznet Curve in case of Pakistan. Fiscal spending, on the other hand, has not only direct negative impact but also an indirect impact on carbon emissions. These findings suggest that government expenditures are environment friendly in Pakistan.

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Keywords: Carbon Emissions; Economic Growth; Environmental Kuznets Curve; Fiscal Spending; FMOLS

1. Introduction

The world has witnessed an immense increase in economic activity since last few decades, which resulted in improved living standards, availability of choices, and higher income levels across the globe. However, globalization and upsurge in economic activity around the globe have also put a great threat to environmental quality by increasing carbon emissions, hence causing irreversible damage to the environment. These damages include Green House Effect, droughts, and floods, melting of glaciers, global warming, and climatic revolution (Bozkurt and Akan, 2014).

This environmental impact of economic activity has also been delineated by empirical literature through Environmental Kuznet Curve (EKC).[1] The empirical research examining

[1] The EKC hypothesis describes degradation in environmental quality at the initial stages of economic growth. However, after achieving a certain level of economic growth, an increase in economic growth helps improving the environmental quality, naming it an inverted-U relationship.

this impact includes Gailanto and Islam (2014), Halkos and Poizanos (2014), Halkos (2012), Halkos and Poizanos (2013), Lopez et al. (2010), and Grossman and Kruger (1995), among others. The EKC based studies classify various factors which determine the inverted U-shaped relationship. In particular, these factors include advancement in production technology, the regulation of polluters, and improvement in institutional set up which may create public awareness against environmental degradation.

To limit the environmental damage caused by economic activity, recently, governments intervene in various ways such as introducing environmental laws, creating awareness among households and firms to use resources in environment friendly ways, and also introducing such projects which lowers the overall burden on environment. Furthermore, a large number of researches have examined the impact of government spending and economic growth on environment separately until the IS-LM-EE model establishes the trinity of policy, growth and environment. The theoretical background in this regard has been pioneered by Heyes (2000) and extended by Lawn (2003) and Sim (2006). These studies have incorporated environmental equilibrium with simple IS-LM framework to identify the environmentally sustainable level of output. In particular, Sim (2006) has concluded that sustainable economic development must be accompanied by improved quality of environment.

The theoretical foundation in the form of IS-LM-EE framework provides an impetus to empirically examine the trinity of policy, growth and environment. Therefore, the empirical studies attempt to examine the impact of policy, particularly fiscal policy on environment. This strand of literature provides the significant impact of fiscal spending on environment directly as well as indirectly through GDP growth. The noteworthy contributions in this regard are Halkos (2003), Bernauer and Koubi (2006), Lopez and Palacios (2010), Hussain, Attari and Drake (2011), Lopez et al.(2011), Shahbaz and Leitao (2013), Halkos and Paizanos (2013), Halkos and Paizanos (2014), and Bozkurt and Akan (2014).

As Pakistan is a developing economy, therefore it requires an intense use of natural and man-made resources for higher economic growth, thus putting a pressure on environment quality. In this regard, Government of Pakistan has taken various initiatives to reduce the degrading impact of growth on environment. Therefore, it is important to examine whether government actions are environment friendly, environment damaging or neutral, in case of Pakistan. To the best of our knowledge, this relationship has not been examined for Pakistan. Therefore, the present study is an effort to empirically investigate the impact of government expenditures on environment for the case Pakistan. The primary objective of this study is to test the direct, indirect and total impact of government expenditures on environment quality in Pakistan. In addition to this, we also aim to test the existence of EKC hypothesis in case of Pakistan.

The analysis is carried out for the period 1960-2013. The study measures fiscal actions by using government final consumption expenditures and carbon dioxide emissions (CO_2) are taken as a proxy of environment quality. To test the time series properties, the study employs CMR test of stationary and structural stability. Fully Modified Ordinary Least Square (FMOLS) technique has been employed to test the above-mentioned relationship empirically.

The empirical findings suggest an environment friendly impact of government spending in Pakistan as indicated by the negative sign of the coefficient of government spending for CO2 emissions. However, the indirect impact through income level appears as

positive suggesting an environment degrading impact of fiscal spending through income level. Interestingly, the total impact of government spending turns out as negative. This signifies the importance of government actions in reducing the environmental degradation. In addition, the findings also support the existence of EKC hypothesis for Pakistan. This implies that at initial stages of economic growth, the environment quality will degrade but after acquiring a certain level of income, the environmental quality will improve as GDP growth increases.

This study is organized in five sections. Section 2 discusses the findings of existing literature regarding the relationship between government expenditures, growth and the environment. Section 3 explains the methodology and data. Section 4 provides the discussion on empirical findings. Finally, Section 5 concludes the study along with some policy recommendations.

2. Literature Review

The theoretical relationship between growth, environment and policy actions have been explained by using simple IS-LM-EE framework which describes how policy actions can create a favorable or harmful impact on environmental quality. The novel contribution, in this regard, is provided by Heyes (2000), Lawn (2003), and Sim (2006). These studies argue that policy actions combined with economic activity results in an environmentally sustainable level of output. Or in other words, the level of output where the use of energy resources is sustainable cab be obtained by a proper mix policy and economic activity.

Earlier to this, the link between output and environment has been explained through an Environmental Kuznets Curve (EKC). The EKC hypothesis explains that the relationship between economic activity and environment depends on the level of economic activity. At initial stages of economic growth, environmental degradation will be high due to intense use of resources. However, as the economies reach at a certain level of income, they employ more conscious use of resources accompanied with improved awareness among all members of the society, thus, reducing the environment degradation. Later on, the addition to this was done by many studies such as Grossman and Krueger (1995), and Shafik and Bandyopadhyay (1992), among others. These studies state that increasing growth damages environmental quality. However, their findings are based on the assumption of keeping preferences, technologies and investments as fixed. Similar findings are reported by Bekerman (1992). In this regard, Bhagawati (1993) also conclude that economic growth is a pre-condition for the improvement of environmental quality.

The empirical literature, however, can be divided into two strands, (i) the literature that discusses the link between environment and growth along with other macroeconomic variables (ii) the recent strand of empirical literature, which explores the impact of policy actions, fiscal policy in particular, on environment. The empirical literature in the first strand mainly tests the EKC hypothesis for different set of countries over varying range of time period. The studies exploring the environmental impact of policy actions evaluate the direct as well as indirect role of fiscal policy in affecting the environment.

Bozkurt and Akan (2014) argue that CO_2 emissions must be reduced in order to control the level of pollution and environmental damages. They inspect the relationship between CO_2 emissions, energy consumption and economic growth for Turkey for the period 1960-2010. Their study also suggests that economic growth leads to exhaustion of natural resources and

degradation of the ecosystem by increasing the level of carbon emissions, whereas it improves the living standards of the people as well. Similar finding is reported by Yazdi and Mastorakis (2014), who empirically examine the relationship between CO_2 emissions and economic growth for a period from 1975 to 2011. The results of Granger causality portray a unidirectional causal link between urbanization and energy intensity of CO2 emissions whereas a bidirectional causality between per capita GDP and per capita CO_2 emissions has been observed.

Stolyarova (2013) has observed the link between per capita CO_2 emissions, GDP per capita and energy mix. The study has used carbon dioxide emissions from industrial and power sector. For this purpose, panel data for ninety-three countries for the period from 1960 to 2008 has been used. The empirical findings suggest that GDP per capita intensifies CO_2 emissions whereas the effect on growth rate of energy mix is negative. Harmoniously, Shahbaz and Leitao (2013) conclude that the pollution level measured by carbon emissions escalates in response to higher economic growth in Portugal over the period of 1970-2009.

Ozuturk and Acaravci (2011) argue that CO_2 emissions have grown severely in the past century mainly due to human activities such as using fossil fuels in large amounts as well as increase in land use for agriculture and housing that are connected with increasing GDP and development of a nation. CO_2 emissions from the use of fossil fuel and other human activity is effecting the global climate. Meyerson (1998) reports that both population and economic growth lead to the extensive use of energy and thus cause CO_2 emissions. So, in order to control the global warming, caps on the national CO_2 emissions for all countries must be established

Pakistan as a developing country has shown concerns regarding the environmental quality and taking steps in developing new standards and monitoring networks to reduce CO_2 emissions. The EKC hypothesis has also been tested for the case of Pakistan by different studies. The overall findings are mixed, at its best. Hussain, Attari and Drake (2011) test the EKC hypothesis for Pakistan by using data on energy consumption, CO_2 emissions and economic growth over the period 1971-2006. Granger causality test shows a long-term relationship between all these indicators. Further, the results also indicate that with an increase in GDP, per capita CO_2 emissions increases. The notable contributions in this regard are done by Nasir and Rehman (2011), Ahmed and Long (2012), Ismail et al. (2014), and Shehbaz et al. (2015), among others.

Recently, the empirical studies attempt to investigate how policy actions can influence the environmental quality by following the theoretical framework provided by IS-LM-EE. The notable contribution in this regard is by Halkos and Paizanos (2014). They examine the impact of economic growth and government spending on the environment quality by using CO_2 and SO_2 emissions as indicators of the environment quality. Seventy-one countries for the time period from 1970-2008 have been selected for the empirical analysis. The study reports the presence of inverted U-shaped relationship between economic growth and pollution. In addition, the study concludes an environment friendly impact of government expenditures on SO_2 emissions only. The study also reports that degradation in the environmental quality may react to changes in income and government spending with a time lag.

This link between environment, growth, and fiscal spending has been tested empirically by Halkos and Paizanos (2013) for a panel of seventy-seven countries by covering the time

period from 1980 to 2000. The empirical findings reveal a negative impact, direct as well as indirect, on SO_2 emissions for lower levels of income whereas this effect turns out positive as income level rises. In contrast, the effect is negative for CO_2 emissions for the entire income range taken by the study. Galinato and Galinato (2013) claim that moving towards a countercyclical spending pattern leads to an involuntary consequence during the recession. By using the data from 1990 to 2003, the study concludes that that government-spending results in forest land clearing for agricultural production thus leading to deforestation-induced CO2 emissions.

The impact of government expenditures and environmental taxes on environmental quality, in Europe, has been examined by Lopez and Palacios (2010). For empirical analysis, the study estimates the impact of government spending and energy taxes on air pollution by using data for 21 European countries from 1995-2006. The findings of the study reveal that the provision of public goods has contributed in a very significant manner to make them environmentally clean. In addition, it is shown that high-energy tax policy over the last decades has also contributed to reduce pollution.

In the similar vein, Halkos (2013) tests the trinity link of environment, government expenditures and GDP by using panel of seventy-three OECD and non-OECD countries over the period 1960–1990. The study argues that the indirect channel through which government expenditures may affect pollution depends on the expenditures to income and also on income to pollution relationship. The study suggests that low income countries can flatten out their EKCs by giving property rights over natural resources, along with transparent policies regarding environment and charging those sources which cause the emissions. The empirical findings of the study, however, are highly sensitive to change in estimation techniques.

New inventions and improvements in energy usage play an important role in minimizing CO_2 emissions. Garrone *et al*. (2010) state that while making the policies of climate protection and energy use, new technology's diffusions and utilization must also be taken into account. By taking 13 advanced economies for the time period of 1980-2004, the findings of the study confirmed that R&D spending is not enough to increase the energy innovation in the country.

In conclusion, the empirical studies provide inconclusive estimates regarding the impact of government expenditures on environment over varying time spans and different sample of countries. However, no considerable work has been done in this concern with reference to Pakistan. Therefore, it is important to investigate how increasing government expenditures contribute towards environmental quality in Pakistan. This study, therefore, examines this impact and fills the gap in the existing literature.

3. Analytical Framework

This study empirically explores the direct and indirect impact of government expenditures on CO_2 emissions for the case of Pakistan over the period 1960-2014. In this regard, we estimate the following model which is adapted from Halkos and Paizanos (2013).

$$CO_{2,t} = \alpha_0 + \alpha_1 EXP_t + \alpha_2\, GDPC_t + \alpha_3 GDPC_t^2 + \alpha_4 EXP * GDP_t + \alpha_5 GFCF_t + \alpha_6 POP_t + \alpha_7\, TO_t + \alpha_8 HC_t + \mu_t \quad (1)$$

In the above model, *t* represents time period of 1960-2014. RCO_{2t} is the log of Real Carbon Dioxide Emissions (Kilo Tons), EXP_t represents the log of Government Consumption Expenditures as Percentage of GDP, $RGDP_t$ is the log of Real GDP per Capita, $(RGDP)_t^2$ is the log of square Real GDP Per Capita, $RGFCF_t$ shows the log of Gross Fixed Capital Formation as a percentage of GDP, POP_t indicates Population Growth, TO_t is the Log of Trade Openness, and $EXP * GDP_t$ represents Interaction of Govt. expenditures with Real GDP Per Capita. All variables are expressed in log form except human capital and population growth.

Equation 1 estimates the direct effect of government expenditures and GDP per capita on carbon emissions along with other determinants. Also, this equation helps in estimating the EKC hypothesis for Pakistan. In addition, the coefficient of the interaction term of Govt. expenditures with GDP captures the indirect effect of government expenditures on environment through GDP per capita. The total impact is computed at the end by combining the direct and indirect effects.

The data on selected variables are accessed from different data sources that includes World Development Indicators (WDI, 2010), Hand Book of Statistics on Pakistan Economy (2005), and Penn World Table 8.1. To carry out the empirical investigation, we first test the times series properties of the data. Since most of the times series data exhibit non-stationarity, therefore, to avoid spurious regression estimates, it is important to test the stationarity properties of each time series. This step helps in identifying the appropriate estimation technique and thus efficient estimates to accomplish the objectives of the study. We use Clemente, Montanes, and Reyes (1998) test to test the existence of unit root in selected series along with evidence of structural stability. This test is preferred over the traditional Augmented Dickey–Fuller (ADF) test by Dickey and Fuller (1979) as it is not valid when data exhibit any structural break.

This study employs FMOLS estimation technique in order to examine the direct and indirect impact of government expenditures on environment. The method was originally introduced and developed by Philips and Hansen (1990) for estimating a single co-integrating relationship that has a combination of I(1). This technique is preferred over other available techniques as it has some advantages over previous techniques. In particular, this method is more efficient in presence of endogeneity and produces reliable estimates when the sample size is small.

FMOLS technique is designed to estimate cointegrating relations directly by modifying traditional OLS with non-parametric corrections that takes into account serial correlation, caused by unit roots, and system endogeneity, caused by cointegration. Furthermore, Phillips (1995) has shown that the FMOLS estimation technique yields t–statistics for parameter estimates, which have a normal limiting distribution even in the presence of cointegrated explanatory variables.

4. Results and Discussion

Before carrying out the empirical analysis, we test the order of integration of each time series. The estimates are presented in Table 1. The estimates of CMR test depict that all the

selected time series are stationary at first difference indicating that selected series are integrated of order one, I(1).

Table 1: CMR Test Estimates

Variables	t statistics	Critical value (5%)	Order of Integration
CO_2	-0.35	-4.44	I(1)
EXP	-2.78	-4.44	I(1)
GDPC	-0.33	-4.44	I(1)
$GDPC^2$	-1.08	-4.44	I(1)
GFCF	3.00	-3.56	I(1)
EXP_GDP	-3.40	-4.44	I(1)
POP	-3.21	-4.44	I(1)
HC	-0.04	-4.44	I(1)
LTO	-3.12	-4.44	I(1)

4.1. The Environmental Impact of Government Expenditure

The empirical estimates are displayed in Table 2. The results show that all variables significantly affect carbon dioxide emissions and also carry expected sings. The post estimation cointegression estimates are also reported which confirms the existence of cointegression in the selected model.

The direct effect of government spending on carbon emissions portrays a negative coefficient of government expenditures with statistical significance at the 5% level of significance. This suggests that higher government expenditures reduce carbon emissions in Pakistan over the selected time period with a magnitude of 0.17%. This finding is in line with the results of Halkos and Paizonas (2013). Their study have also explained a negative effect of government expenditures on carbon dioxide emissions for low and middle income countries, whereas, it is positive for high income countries. Similarly, López and Palacios (2010) conclude that fiscal policies are important determinants of pollution; increasing participation of the government in the economy and especially a more public goods orientation of spending are important factors in reducing air pollution. In addition, Lopez et al. (2010) state that government spending on public goods especially social spending including education and health care along with green initiatives leads to reductions in pollution levels.

In order to compute the indirect impact, we interact Govt. Expenditure variable with GDP Per capita. The interaction term identifies a positive impact of government spending on

carbon emissions through GDP per capita. By combining the direct impact with indirect impact it is concluded that the negative impact of government spending on carbon emissions increases as the level of GDP per capita increases. Alternatively, government spending is environment friendly at higher levels of GDP.

Table 2: FMOLS Estimates: Environmental Impact of Government Expenditures

Variables	Coefficients	t-stat
EXP	-0.180**	-2.09
GDPC	4.30***	4.65
$GDPC^2$	-0.27***	-4.43
EXP_GDP	0.02**	2.029
TO	-0.25	-1.171
HC	-3.94***	-4.26
POP	0.11**	2.243
C	-7.40**	-2.471
@TREND	-0.05**	-2.25
@TREND^2	0.003***	4.72
Engle-Granger tau-statistic	-4.49*	0.096
Engle-Granger z-statistic	-33.84***	0.0185

***, **, and * indicates significant at the 1 %, 5%, and 10% level of significance.

Finally, after computing the direct and indirect impact separately, we calculate the total effect of fiscal spending on carbon emissions. In this regard, we take the sum of the direct and indirect impact as follows:

$$Total\ Impact\ = Direct\ Impact + Indirect\ Impact$$

$$-0.18 + \ 0.02 = \ -0.16$$

Hence, we obtain a negative estimate of the total impact of fiscal spending on carbon emissions. This implies that the overall impact of government spending is environment friendly in Pakistan. Halkos and Poizanos (2013), Halkos and Poizanos (2014), and Gailanto and Islam (2014) also report that fiscal spending is environment friendly in low and middle income countries. In contrast an adverse impact has been shown by the study of Lopez et al. (2010).

Currently, in Pakistan, many governmental organizations and non-governmental organizations are working to protect the environmental standards. According to Ministry of Environment, Local Government and Rural Development, to protect environment, Pakistan Environmental Protection Council (PEPC) was first constituted in 1984 which aims to implement the Pakistan Environmental Protection Act. Pakistan Environmental Protection Agency was created under 1983 Ordinance, which is responsible for pollution control.

Another objective of this study is to test the existence of EKC for Pakistan. We can observe that the empirical estimates reveal a positive sign of GDP per capita. This finding suggests that with increase in income, carbon emissions increases by 4.30 percent at the 1 % level of significance. In contrast, the squared GDP per capita term appear as negative and statistically significant. While combining the level and squared GDP coefficients, we can conclude that increase in GDP deteriorates environmental quality (increases carbon emissions), however, after reaching a certain level of GDP, increase in GDP improves environment quality i.e. decreases carbon emissions in Pakistan. Based on these findings, we can conclude that EKC hypothesis does hold in case of Pakistan.

A possible mechanism for this type of relationship between GDP per capita and environmental quality can be explained as follows: When nations become rich, the citizens' demand for improvement in the non-economic aspects of their lives also increases. Therefore, rich countries tend to have cleaner urban air than poor and middle income countries, as they have strict enforcement of their environmental laws. Another reason is that, when countries develop they terminate to produce pollution-intensive products and begin to import those products from low-income countries. The awareness of environmental hazards and the development of new technologies might help the developing countries to protect their environment.

These results are consistent with the findings of Ahmed and Long (2012), Nasir and Rehman (2011), Ismail et al. (2014), Shehbaz et al. (2015). These studies have also proved the existence of EKC hypothesis for Pakistan. Halkos and Poizanos (2013), Halkos (2012), and Grossman and Krueger (1995) have also proved that the increases in GDP may be linked with deteriorating environmental conditions in poor countries. However, the environmental quality may improve when countries developed and substitute cleaner technologies for dirty ones.

We now turn to discuss the environment impact of other variables in the model. The estimates indicate that 1 % percent increase in population growth increases carbon emissions by 0.11%. In this regard, Shi (2003) concludes that population growth has been one of the major driving forces behind increasing CO2 emissions. Similarly, Sadeghi et al. (2004) state that population growth leads to increase demand for agriculture land, energy resources and water resources. This destroys forests and pastures, deteriorates agriculture land fertility, and thus, pollutes the environment.

The coefficient of human capital indicates that a 1 % increase in human capital decreases CO_2 emissions by 3.94 percent. Human capital index includes education, skills, health and efficiency of individual so the expected relationship of human capital with pollution is negative. Human capital of a country improves the economic structure and country moves towards industries and services sector which are information intensive. At this level, the environment consciousness rises and useful environmental regulations are implemented which promotes environmental conditions (Safdari et al., 2013).

Estimates of trade openness show that trade openness reduces CO_2 emissions by 0.25 percent for the case of Pakistan. Similar findings are reported by Choi et al. (2010). Their study explains that trade openness is ultimately directed towards more concern for environmental protection due to increased standard of living resulting from economic growth. In accordance with this, Nimubona (2012) argues that trade-based incentives to impose good environmental governance are also emphasized by trading partners. The economies can make its environmental quality good only if environmental policy advances along with trade liberalization (Anderson, 1992, 1998; Esty, 1994). Antweiler (2011) stresses that countries can build ability and develop skills in trading environmental friendly goods to achieve sustainable economic development. The study further states that suitable policy measures can support such research findings that promote free trade to be good for environment as well. In contrast, some empirical studies provide the evidence that trade deteriorates environment quality in developing countries. It only helps developed countries to improve their environmental quality by shifting the pollution intensive industries to developing countries. These studies include Copeland and Taylor (1994, 1995), Yunfeng and Laike, (2010), Adamowicz and McCarney (2005), among others.

5. Conclusion and Recommendations

Fiscal spending in developing countries mainly aims to improve the economic and social performance. In addition to these traditional tasks, recently governments around the world have also focused on maintaining environmental standards at its best. Theoretically, fiscal actions may help improving the environmental standards by recognizing the environmentally optimal level of growth as explained by IS-LM-EE framework. On the empirical grounds, however, the researchers have provided mixed evidence regarding the impact of government expenditures on environment. An environment friendly impact of fiscal spending has been documented by Halkos and Poizanos (2013), Halkos and Poizanos (2014) and Gailanto and Islam (2014). In contrast, an adverse impact has been shown by the study of Lopez et al. (2010).

The literature has identified three effects which government expenditures may have on environment, namely scale effect, composition effect and technique effect. These can be explained as follows. First, the scale effect describes that high growth rates increase pollution in the short run, however, in long run the adverse impact on carbon emissions reduces due to higher scale of production. Second, improvement in production process such as moving towards human capital intensive technique from physical capital techniques of production helps reducing pollution. Finally, creating cleaner technologies, improving labor efficiency, investments in research and development and easy diffusion of knowledge decreases output based pollution. (Antweiler et al. 2001; López et al. 2010).

There is reasonable amount of literature available which empirically investigates both the direct and indirect impact of fiscal spending on environment. However, this relationship is not investigated for Pakistan, to the best of our knowledge. Therefore, to bridge this gap in the existing literature, we carry out an empirical analysis in order to investigate the impact of fiscal spending on environment. In doing so, we use time series data on carbon dioxide emissions, government expenditures, trade openness, human capital and population for the

period 1960-2014. The empirical analysis is carried out by using FMOLS estimation technique.

The empirical results reveal a significant negative direct impact and a positive indirect effect of government expenditures on CO_2 emissions. Our results are in line with the studies of Lopez et al. (2010), Halkos and Palacios (2010) and Halkos and Poizanos (2013) that reported a negative direct impact of government expenditures on environment and the indirect impact depends on the level of income of that country. For calculating the total impact of government expenditures on carbon emissions in Pakistan, the direct and indirect effects are added. The results show that the direct effect was dominant than the indirect effect, hence the total negative effect of government expenditures on carbon dioxide emissions appears negative. This implies that government expenditures in Pakistan are not environment damaging.

Our study has also test the presence of Environment Kuznet Curve hypothesis for Pakistan. The results of this exercise reveal a positive coefficient of GDP, whereas, GDP^2 holds a negative sign. This implies that at initial stage of growth, environmental quality degrades. However, after reaching a certain level of growth, the adverse impact starts diminishing. This shows that in the short run, the economic activities and economic growth will affect environment adversely as country is on the way of development. Movement towards industrialization, increase in income levels, investments, and new projects will lead to increase in the GDP level which initially will increase pollution. While in the long run, when certain level of income is achieved, there will be higher level of education and human capital which will create awareness regarding the harmful effects of pollution, among individuals and society as a whole. This, resultantly, will lead to the reduction of carbon dioxide emissions in the country. Increase in income may induce a higher demand for more strict regulations and cleaner environment, which is known in as the income effect on environment.

Pakistan is the signatory of many international treaties for environmental protection. Besides, some national laws to protect and enhance environment quality are also implemented. This also supports the findings of our study that government expenditures are environment-friendly. The empirical findings of this study suggest that government expenditures should maintain the eco-friendly behavior not only in the short run but also in the long run. Also, the more effective way to control environmental degradation is to improve the regulation of environmental laws. In addition, Government of Pakistan may also take steps to invest in the environmental friendly and renewable energy sources like hydro, wind, and solar energy as it will not work at the cost of environment. This will further strengthen total impact of government expenditures on pollution. In conclusion, higher income growth can be enjoyed with good environment conditions by using effective policy actions.

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