Global Management Journal for Academic & Corporate Studies (GMJACS)
Fall 2022, Vol 12 No. 2, PP. 138-155

Published by Bahria Business School, Bahria University Karachi Campus

The Environmental Consequences of FDI and Trade Openness: Evidence from Pakistan

Liaqat Ali[1], Amir Manzoor[2], Muhammad Mutasim Billah Tufail [3], Rao Muhammad Rashid[4]

ABSTRACT

The objective of this study is to determine the impact of trade openness (TO) and foreign direct investment (FDI) on quality of environment in Pakistan. This study used ARDL bound test for co-integration, covering the period from 1975 to 2019. Statistical soundness of model is verified by using diagnostic tests. The findings of ARDL bound test indicate a long run (LR) relationship between variables. The feedback coefficient confirms the adjustment in equilibrium in the LR. The outcomes reveal that both in LR and short-run (SR), FDI is detrimental for environment quality. Whereas, trade openness improves environment quality in the LR but it is harmful in the SR. The findings endorse the presence of Environmental Kuznets Curve in Pakistan. Residual based diagnostic tests ratify the statistical soundness of the model. The results suggest that while pursuing trade openness and FDI friendly strategies for economic expansion in Pakistan, policymakers should also take care of the environment security. Otherwise FDI, trade-led growth will be threatening environmental sustainability in a developing country which might be jeopardizing socio-economic development.

Keywords: FDI, trade openness, environment, ARDL bound test, Kuznets curve

[1]Senior Associate Professor, Management Studies Department, Bahria Business School, Bahria University, Karachi
[2]Associate Professor, KSBL, Karachi
[3,4] Senior Associate Professor, Management Studies Department, Bahria Business School, Bahria University, Karachi

1. INTRODUCTION

In today's world, globalization is the overarching theme. In this world, the role of trade flows and FDI in the socio-economic development of developed, emerging, and developing countries is undeniable. It is hard to imagine that any nation today can progress and become competitive without increasing trade flows and FDI in the country. Countries more open to investment inflows and trade have a tendency to be more productive and grow rapider (Harrison, 1996; Davies &

Quinlivan, 2006; Hoekman,2017; Tariq et al., 2018;Ali et al., 2019).

From the last four decades, concern about the fragility of the environment and its protection is successively increasing nationally and globally. We can see that developed world is feeling the severity of the situation more than the developing world. Reasons for this may vary, but one probable reason is the stronger economic impact of environmental degradation on the developed world. Accordingly, integration of economic and environmental concerns emerged as an issue and has prominence in academia and public policies, particularly after the Rio Earth Summit1992. Ecological sustainability is one of the dimensions of sustainable development. The increasing global temperature and various climate disasters have made it difficult to attain sustainable development goals (Stern, 2009).

Pakistan is suffering from environmental problems including rising air and water pollution (Pasha, 2014; Economic Survey of Pakistan [ESP], 2018-19). Pakistan is ranked at 7th position in the list of most harmfully affected states by climate variation (E S P, 2017-18). According to Umar and Asghar (2018), Pakistan's score in sustainable development goals (SDGs) index is 55%.With this low score, it is very difficult to achieve SDGs for Pakistan by 2030. Carbon dioxide emission in Pakistan has reached to 196.2 MT. It is rising yearly at the rate (average) of 3.34% (World Bank, 2020). CO2 emissions are major peril of climate change and worldwide warming (Apergis & Ozturk, 2015). Human health is one of the key determinants of human capital (a key source of productivity). Environmental degradation deteriorated human health in a number of ways (Speldewinde, 2006). The quality of environment determines our quality of life. Environmental pollution creates one of the major hazards, not only to human being but also to the existence of nature itself. Pollution damages human health by negatively affecting the environment and directly damaging the biological and sometimes the psychological composition as well (Kaur, 2007). During the last 40 years, we have witnessed a sharp increase of CO_2 in the air. This increased concentration has resulted into global warming and life-threatening climate changes (Amuka et al., 2018). The above discussion implies that moving on the trajectory of sustainability, along with improvements in social and economic indicators, controlling environmental degradation is a grave concern for developing countries (such as Pakistan). Pakistan needs to focus on policy building on this very important issue. Continued environmental degradation can have multifaceted impact on Pakistan economy and can derail Pakistan from its path of sustainable development in the coming years.

From the last decade, Pakistan is facing macroeconomic issues such as low growth, unemployment, trade deficit, fiscal deficit, low foreign reserve, etc. Generally, there is consensus among many renowned Pakistani economists and international

experts that trade and FDI might be the panacea of these issues. Therefore, much attention has been given to increase trade flows particularly exports and FDI inflows in Pakistan. To achieve long term socio-economic objectives all three dimensions of sustainability (social, economic and environment) are equally important. The economies seeking for development without considering the environmental degradations are facing challenge of water pollution, air pollution, depletion of ozone layer and extreme climatic changes (Furtado et al., 2000). The policies that encourage economic growth should not be anti-environment (Yandle*et* al*., 2002).* Despite confessing the developmental benefits of trade and FDI, environmentalist's argument debunks that environmental cost is the flip side of the trade (Ozturk& Al-Mulali, 2015; Zhang, 2018; Huang et al., 2019, Acheampong et al*.,* 2019) and FDI (Shahbaz et al., 2015; Baek, 2016; Zugravu-Soilita ; 2017) led economic expansion, particularly in a developing country where environmental regulations are less stringent. Countries that are boosting their growth through enhancing FDI inflows and trade openness are facing a decrease in environmental sustainability (Sun et al., 2019).

A significant number of studies examined the growth-oriented impact of TO and FDI. However, there is a dearth of studies that examine and give a definite endorsement of ecological outcomes of TO and FDI. Empirical outcomes on the influence of FDI and TO on the environment are highly inconclusive and mixed particularly in case of Pakistan. Moreover, sample size in preceding studies is inadequate (N < 40) for a robust time series analysis. The current study aims to investigate whether TO and FDI are detrimental or beneficial for environmental quality in Pakistan. The present study uses up-to-date and large sample size covering 45 annual observations (1975-2019) as compared to the previous studies on this issue for Pakistan. This study uses net FDI inflows instead of overall FDI inflows to probe its contributions in environment. Moreover, relatively new bound test technique of co-integration is used in order to achieve objective of the study. The deliberation of this research is in general consistent with the UN sustainable development goals (also called SDGs) and the priorities of the government of Pakistan. These SDGs are part of UN agenda-2030. Government of Pakistan has taken many policy initiatives to protect climate. These initiatives include Act 2017 (Climate Change), Climate Change Policy (2014-2030) and 'Green Pakistan Program'. The present study adds to the unending discussion on the TO and FDI as determinants of sustainable development in a low middle income country like Pakistan. The finding of this study would help in designing the strategies for controlling environmental degradation and achieving sustainable development.

The sequence of the study is as given. After the introduction, the next sections are literature review, methodology, empirical analysis, conclusion, and recommendations.

2. LITERATURE REVIEW

2.1 Theoretical Literature

Recently, the worldwide debate has increasingly focused on environmental protection, directing the transition from production and consumption led models towards a sustainable economy (Falcone, 2020).

Despite criticism, directly or indirectly, Environment Kuznets Curve (EKC) hypothesis, Pollution Haven Hypothesis (PHH), and Porter Hypothesis (PH) remained a key reference point of studies on the theoretical and empirical linkages of trade and FDI with the environment. The EKC hypothesizes an inverted-U shaped (∩) association between environmental degradation and development. According to EKC in a pre-industrial economy level of pollution increases at the early stages of development, and eventually falls after reaching a threshold level (Onder, 2012). In a common view, trade and FDI formed the EKC via trade and FDI-led economic development in a developing country. One of the logics of the EKC hypothesis can be traced from consumer theory. Microeconomics texts describe that demand for normal goods rises with an increase in the level of income and demand for inferior goods declines with a rise in income. It implies that at the initial stage the quality environment for the people is an inferior good, therefore, the pollution level rises. After a threshold level of income quality environment becomes a normal or luxury good, consequently pollution decreases. Ruttan and Vernon (1971) concluded that income elasticity of the demand for environmental amenities is inelastic at a low level of income and elastic at a higher level of income. PHH postulates that relaxing trade or FDI rules cause the polluting industry to move to countries where environmental policy is less stringent (Copeland, 2008; Copeland, 2010). According to PHH the concentration of 'dirty industry' in a developing country takes place through the international trade flows and FDI. The PHH has been evaluated in various studies, but no decisive outcomes can be drawn about the presence of the PHH so far (Gill *et al.*, 2018). Porter's hypothesis (PH) is contrary to PHH. According to PH, stringent environmental regulations can induce environment-friendly technology in host countries. Due to which environmental quality improves in the host countries. PH states that environmental standards and regulations enable firms to develop eco-innovations and increase the performance of firms via technical efficiency which may improve natural environment. It is usually believed that a developing country has flexible environmental regulations compared to an advanced country. Therefore, trade liberalization and FDI inflows will worsen the environment quality in a low middle-income country like Pakistan.

The effect of a marginal change in FDI inflows and TO on the environment quality is divided into three types of effects: channels of scale, composition, and technique. These three effects refer to variation in environmental contaminants because of increasing level of production, change in the relative shares of

goods in the aggregate output and alteration in methods of production, respectively (Grossman & Krueger, 1991; Copeland & Taylor.2003; Onder, 2012; Shabaz et al., 2019). Regardless of controversies, a significant amount of literature documents that FDI and TO have a considerable contribution to economic growth. Economic growth gives rise to production, consumption, and demand for energy, which are considered the main sources of CO2 release (Lau *et al.*, 2014; Ren et al., 2014; Shahbaz et al., 2015; Azam & Khan, 2016).

2.2 Empirical Literature

The empirical studies identified both good and bad impacts of TO and FDI on quality of the environment. A number of the empirical studies conclude that trade improves the quality of environment (Panayotou,1993; Helpman, 1998; Antweiler et al., 2001; Shahbaz et al.,2012; Shahbaz et al., 2013;Jebli et al, 2016; Zhang *et al*.,2017; Saud,2019). Conversely, several pieces of research identified the detrimental impact of TO on environment quality (Cole et al., 1997, Lopez, 1997; Strutt & Anderson,2000; Ozturk & Al-Mulali, 2015; Wang& Zhao, 2015; Zhang, 2018;Huang et al., 2019).

Halicioglu (2009) applying the ARDL approach scrutinized the associations of energy consumption, TO, income with $CO_2$from 1960 to2005 in Turkey. Results disclose that TO, energy consumption, and income increase CO2 emission. Le et al. (2016) examined the association of TO with environment for a panel of 98 countries. Using CO_2 as dependent variable result of the study confirms the harmful impact of TO on environment quality for low-income and middle-income countries. Bernard and Mandal (2016) scrutinized the influence of trade intensity on the environment by using the GMM technique for a panel of 60 developing and emerging economies from 2002 to 2012. This study uses CO2 as a measure of the quality of environment. The results reveal the harmful influence of trade, population, consumption of energy, and income on quality of environment. Similarly, Yu et al. *(*2019) investigated for Commonwealth of Independent States (CIS) countries from 2000 to 2013. Applying GLS analysis in their study, researchers conclude that TO directly increaseCO_2 in CIS countries. Hakimi and Hamdi (2019) examined the impact of TO on environment quality for the panel of 143 countries from 2006 to 2015. Using GMM method in the aggregated analysis (all countries) and disaggregated analysis (43 developed country and 100 developing countries) the results reveals that TO improves environment quality in the aggregated analysis, whereas in disaggregated analysis TO deteriorate environment quality.

Hitam and Borhan (2012) probed association of FDI with the environment in Malaysia for 1965-2010. The results validate the EKC hypothesis in Malaysia. This study concluded that FDI increases environmental degradation. Shaari et al. (2014) scrutinized the impact of FDI and growth on CO2 for a panel of fifteen developing countries using the

data from 1992 - 2012. They concluded that FDI has no considerable contribution to CO_2 emissions independently. Neequaye and Oladi (2015) scrutinized the impact of FDI flows and environmental aid on the environment in 27 developing countries for the period of 2002 to 2008. They found that FDI flows deteriorate the environment and environmental aids improve environmental quality in 27 developing countries.

In a time-series study, Seker et al. (2015) scrutinized the relationship of FDI with carbon emissions in Turkey from 1974–2010. The results revealed that FDI increases CO2 in Turkey in the long-run. They recommended the permission of environment-friendly FDI in Turkey. Hakimi and Hamdi (2016) explored the influence of FDI and trade intensity on the environment (CO2) in Morocco and Tunisia throughout 1971-2013. Researchers concluded that TO and FDI worsen the environment quality in Tunisia and Morocco. Similarly, Riti *et al.* (2016) identified the positive effect of FDI and manufacturing exports on CO2 emissions in Nigeria for the period of 1980-2012.Zheng and Sheng (2017) found that FDI increases CO2 emissions in 30 provinces of china without market-oriented reforms covering the period 1997-2009. Employing the ARDL for the years 1996-2017, Sun et al. (2019) evaluated the effect of FDI and trade along with other variables on environmental degradation (CO_2 emissions) in SAARC countries. They concluded that trade and FDI adversely affect environmental quality in SAARC countries in the LR, while trade and FDI reduce CO2 in SR. Applying the GMM method for the years 1990–2015, Shahbaz et al. (2019) investigated FDI and CO_2 relationship in the Middle East and North African (MENA) region. The results endorse the validity of EKC and PHH in the region. This study found an N-shaped association between CO2 and FDI in MENA. Applying ARDL with the structural break, Shabaz et al. (2019) analyzed the impact of TO and FDI on the environment for the period 1965-2016 in the U.S. They found that TO decrease environmental degradations by reducing CO_2, while FDI deteriorates environment quality by increasing CO2 in the U.S. Acheampong et al. (2019) used trade openness (TO) and FDI to evaluate the impact of globalization on CO2 in 46 sub-Saharan African nations for 1980-2015, and exposed that FDI reduces CO2, while TO depreciate the quality of the environment. Khan et al. (2019) tested validity of EKC for four South Asian countries (Pakistan, Bangladesh, India, SriLanka, Nepal) covering the duration of 1990 - 2015. The findings of the study endorsed the existence of EKC in five South Asian countries. Similarly, Apergis and Ozturk (2015) found EKC for fourteen Asian economies.

The studies on the relationships of TO and FDI with environment in Pakistan (Khalil & Inam, 2006; Azhar et al., 2007; Alam et al., 2011; Ahmed & Long, 2012; Munir & Khan,2014) are not only insufficient in number but also did not find conclusive results. For instance, Khalil and Inam found the harmful impact of FDI but no influence of TO on the environment in Pakistan. Conversely, Azhar et

al. (2007) identified that trade increases water and air pollution in the SR and the LR. Whereas Alam et al. (2011) identified that TO has a favorable influence on quality of environment in Pakistan. Similarly, Ahmed and Long, (2012) applying ARDL bound testing claimed that TO increases quality of environment by decreasing CO_2emissions in Pakistan. Likewise, Shahbaz and Lean (2012) identified that TO decreases CO_2 emission in the LR only while economic growth and consumption of energy enhance CO2 emissions in the LR and SR. Munir and Khan (2014) found that trade damages quality of the environment in the LR in Pakistan.

From the survey of literature, we observed that despite pro-trade and pro-FDI argument for the relationship between trade, FDI and environmental sustainability, empirical finding are mixed particularly in case of Pakistan. Some of the panel and time series studies validate the argument and other counterargument. Whereas, some of the studies found insignificant relationship between trade, FDI and environment. Trade and FDI related policy measures are not comparable across the countries, so conceiving a country specific lessons from cross county evidence also raises questions. Moreover, in most of the panel studies Pakistan has not been included. Since the empirical results remain inconclusive, and the effect of trade and FDI on environment is theoretically ambiguous, there is room for further empirical investigation especially for a developing country. So, the present study contributes to the ongoing debate on the TO and FDI as determinants of environment in a developing country like Pakistan. The finding of this study would help in designing the policies for controlling environmental degradation and achieving sustainable development.

3. METHODOLOGY, MODEL SPECIFICATION, AND VARIABLES

This research is explanatory in nature utilizes time series data from 1975 to 2019. Data of (dependent and independent) variables is obtained from WDI (World Bank, 2020). Autoregressive distributed lag (ARDL) is one of the well-known techniques in empirical literature. The ARDL method was advocated by Pesaran et al. (2001). The ARDL has a unique advantage over the conventional techniques for co-integration. For instance, this technique can be employed despite different order of integration, except no variable is *I(2).*This technique addresses endogeneity problem. The technique is more suitable for studies with small sample size (N < 50), while other techniques need a large sample. It captures SR and LR dynamics (see Pesaran et al., 2001; Haug, 2002; Narayan & Smyth, 2005; Alam & Ahmad, 2012; Aslam & Sivarajasingham, 2020). Since the sample size of this study is less than 50 observations, so ARDL bound test for co-integration is used. Macroeconomic time series, in most cases are non-stationary. Regression model with non- stationary variables gives spurious results. Augmented Dicky-Fuller (ADF) test which comprised lagged differenced terms of dependent variable, issued to verify the non-stationarity of the data before estimation. Inclusion of lagged

terms in ADF eliminates higher order serial correlation. The statistical reliability of models is diagnosed through Jarque-Bera, LM test, Breusch-Pagan-Godfrey test, Ramsey RESET Test. Structural stability is tested by employing CUSUM and CUSUMSQ. E-Views is used for estimation analysis.

3.1 Model Specification and Variables

According to EKC hypothesis, quality of environment worsens at an early level of development and later on, after reaching a threshold, environment quality improves. PHH postulates that relaxing trade or FDI rules cause the polluting industry to move to countries where environmental policies are less stringent (Copeland, 2008). According to PHH, the concentration of 'dirty industry' in a developing country takes place through the international trade flows and FDI. In empirical studies, the EKC hypothesis has been the orientation point for models specification. This study parsimoniously specifies the Trade, FDI-Environment model based on EKC, PHH hypothesis (for FDI and trade).Using the EKC Hypothesis as a baseline the basic functional form is as:

CO_2 = f (FDI, Trade Openness, Real per capita GDP, Squared Real per capita GDP)…(1)

The logarithmic form of the model is given:

$$lnCO_{2\,t} = \beta_0 + \beta_1 lnFDI_t + \beta_2 lnTO_t + \beta_3 lnGDP_{Ct} + \beta_4 \ln GDPct^2 + \varepsilon_t \ldots\ldots \text{(2)}$$

Here, ln = natural log, CO_2 = Carbon dioxide emission per capita metric ton as measure of environment degradation, TO = trade openness: export + import to GDP ratio$\left[\frac{(Exports+Imports)}{GDP}\right]$, FDI = Foreign direct investment: ratio of net foreign investment inflow to GDP$\left(\frac{net\ FDI}{GDP}\right)$, GDPC = Real per capita GDP$\left(\frac{GDP}{Population}\right)$, GDPC^2= Squared Real per capita GDP$\left(\frac{\boldsymbol{GDP}}{\boldsymbol{Population}}\right)^2$.GDPC and GDPC^2 are variables of EKC traditionally. Where $\beta_\circ$ intercept and $\beta_1, \beta_2, \beta_3, \beta_4$ are the slope parameters. The EKC hypothesis reveals that $\beta_{3\ GDPc}$>0and $\beta_{4\ GDPc^2}$<0.

The specification of ARDL model is found by transforming the above equation as:

$$\Delta lnCO2_t = \lambda_0 + \sum_{i=1}^{p} \lambda_{1i}\, \Delta lnCO2_{t-i} + \sum_{i=0}^{p} \lambda_{2i}\, \Delta lnFDI_{t-i} + \sum_{i=0}^{p} \lambda_{3i}\, \Delta lnTO_{t-i} + \sum_{i=0}^{p} \lambda_{4i}\, \Delta lnGDPC_{t-i} + \sum_{i=0}^{p} \lambda_{5i}\, \Delta lnGDPC2_{t-i} + \eta_1 lnCO2_{t-1} + \eta_2 lnFDI_{t-1} + \eta_3 lnTO_{t-1} + \eta_4 lnGDPC_{t-1} + \eta_5 lnGDPC2_{t-1} + \varepsilon_t \text{ ..(3)}$$

The 'p' represents lags used for every variable. Here Δ indicates the first difference.λ_1, λ_2, λ_3... $\lambda_5$are SR coefficientsand η_1, η_2, η_3, …. η_5 are LR coefficients estimation. Following are the hypotheses of co-integration:

$H_0: \eta_1 = \eta_2 = \eta_3 = \eta_4 = \eta_5 = 0$ (no long run relationship)

$H_a: \eta_1 \neq \eta_2 \neq \eta_3 \neq \eta_4 \neq \eta_5 \neq 0$ (long run relationship)

The ARDL-ECM is expressed as follows:

$$= \phi_0 + \sum_{i=1}^{p} \phi_{1_i}\, \Delta lnCO2_{t-i} + \sum_{i=0}^{p} \phi_{2_i}\, \Delta lnTO_{t-i} + \sum_{i=0}^{p} \phi_{3_i}\, \Delta lnFDI_{t-i} + \sum_{i=0}^{p} \phi_{4_i}\, \Delta lnGDPC_{t-i} + \sum_{i=0}^{p} \phi_{5_i}\, \Delta lnGDPC2_{t-i} \omega EC_{t-1} + \varepsilon_t \ldots\ldots\ldots \text{(4)}$$

ϕ_1, ϕ_2, ϕ_3….ϕ_5 are SR elasticities, ω is coefficient of ECt_{-1} and EC_{t-1} is the error correction term.

4. ESTIMATION RESULTS AND DISCUSSION

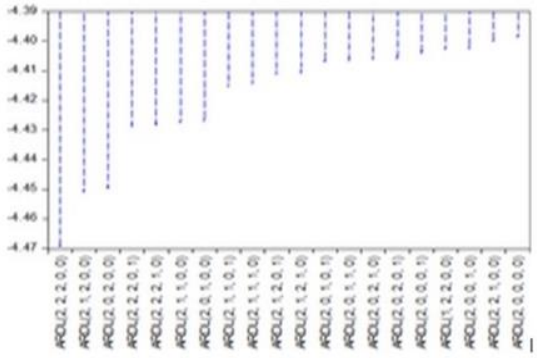
Regression gives spurious results if run without making a series stationary. So, to determine the stationary of the data, the ADF test is used. Table 1 shows the results for the ADF unit test.

The findings indicate that CO2 emission, FDI, TO, GDPC and GDPC² are not stationary at level. Nevertheless, each of the variables is stationary at first difference both with intercept and with the trend.

Table 1: Unit Root Estimation

	ADF (with Intercept)				ADF (with trend and intercept)			
Variables			1st Differ				1st Differ	
	at Level	Prob.	ence	Prob.	at Level	Prob.	ence	Prob.
LCO2	-2.193	0.211	-3.482	0.013	-1.063	0.924	-7.549	0.000
LFDI	-2.888	0.055	4.837	0.000	-2.300	0.425	-8.188	0.000
LTO	-1.628	0.460	-5.049	0.000	-2.152	0.503	5.026	0.001
LGDPC	-0.674	0.843	-4.895	0.000	-1.756	0.709	-4.835	0.002
LGDPC2	-0.417	0.897	-4.762	0.000	-1.853	0.662	-4.686	0.003

Figure 1: Akaike Information Criteria



In the process of estimation, the optimal lag selection is very important because the results of ARDL are very sensitive to lags. An optimal lag length is chosen by Akaike Information Criteria (AIC). Figure 1 demonstrates that AIC (-4.69) of the first model (out of twenty models) is lower most. Thus, the model with the lowest AIC is chosen for estimation. This was counter check by VAR criteria.

Table 2 demonstrates that F-statistics (calculated) is bigger than the upper bound. So, at five percent significance level the null hypothesis of no long-run relationship ($\eta_1 = \eta_2 = \eta_3 = \eta_4 = \eta_5 = 0$) between the variables is rejected. The results of the ARDL bound test endorse the long-run association (co-integration).

Table 2: ARDL Bound Testing

F--Statistic	12.00574	
Critical Value Bounds		
Significance	Lower Bound	Upper Bound
5%	2.26%	3.49%

The results of LR coefficients, SR coefficients, and error correction are illustrated in Table 3.The outcomes reveal that both(in LR and SR) FDI are detrimental for environment quality whereas trade openness improves environment quality in the long run and harmful in the short run. Coefficients of FDI, TO, RGDPC and $RGDPC^2$ are significant at a 1 % level of significance in the LR. Results indicate that in the long run 0.072 % increase in CO2 is led by a 1 % increase in FDI, ceteris paribus. In the short-run 0.02% increase in CO is led by a 1 % increase in FDI. The size of the coefficients shows that CO_2 is relatively more sensitive to FDI inflow in LR. The positive sign on FDI's coefficient indicates that the higher the FDI, the higher the CO_2. The results are consistent with the study of Khalial and Inam (2006) for Pakistan, Hitam and Borhan, (2012) for Malaysia, Seker et al. (2015) for Turkey, Riti et al. for Nigeria, Shahbaz et al. (2019) for the US. The sign (negative) on the coefficient of TO indicates that higher the trade openness, lower the CO2 emission in the LR. The coefficient TO (lagged) is positive and significant at ten percent in the SR. Results show that in LR 0.15%decrease in CO2 is due to a 1% increase in TO and in SR 0.08% increase in CO2 is led by a 1% increase in TO. Results suggest that higher the trade openness lesser is the CO2 emission in the LR. The result is aligned with the empirical study of Ahmad and long (2012) for Pakistan, Shahbaz *et al*. (2012) for Pakistan, Shabaz et al. (2019) for the US. The coefficients of 'GDPC' and '$GDPC^2$' are significant at a 1 % level of significance. The sign (positive) on the coefficient of GDPC and negative on $GDPC^2$ endorse the validity of EKC in Pakistan. Results point out that initially 7.29 % increase in CO2 is led by a one percent increase in RGDPC, later on, a 0.46% decrease in CO2 due to 1% increase in GDPC in the LR. The LR results on the association between RGDPC and CO2 are synchronized with SR. Size of the coefficients of GDPC is higher than the coefficients of FDI and TO. It implies that CO2 is relatively more sensitive to change in RGDPC than FDI and TO. The findings are consistent with the empirical study of Hitam and Borhan (2012) for Malaysia, Shahbaz et al. (2012) for Pakistan, Apergis and Ozturk (2015) for Asian countries, Khan et al. (2019) for five South Asian countries, Shabaz et al.(2019) for the MENA region. The coefficient of the error correction term is positive as well as statistically significant at a 1% significance level. The coefficient of EC (-1) implies that disturbances in the equilibrium are adjusted in the long run at a speed of 0.59%.

Table 3: ARDL results (Long Run, Short Run, and Error Correction)

	Coefficients	Std. Errors	t-Statistics	Prob.
LNFDI	0.074	0.017	4.4614***	0.000
LNTO	-0.158	0.054	-2.9269***	0.007
LNGDPC	7.293	2.168	3.3636***	0.002
LNGDPC2	-0.463	0.163	-2.8432***	0.008
C	-28.227	7.219	-3.9103***	0.001
	Short Run Coefficient and Error Correction			
Variables	Dependent Variable DLNCO2			
D(LNFDI)	0.022	0.011	2.0583**	0.048
	0.013	0.045	0.292	0.772
	0.083	0.043	1.9384*	0.062
D(LNGDPC)	4.334	1.638	2.6462**	0.013
D(LNGDPC2)	-0.275	0.117	-2.3451**	0.026
EC (-1)	-0.594	0.108	-5.4902***	0.000
R-squared	0.756	AIC	-4.664	
Ad. R-sq.	0.695		-4.372	
F-statistic	10.787	H-Q.Criterion.	-4.558	
Prob.	0.000	D.W	2.041	

(***) shows 1%, (**) 5% and (*) shows 10% level of significance

The outcomes of the diagnostic check are shown in Table 4. The finding validates that model is free from autocorrelation and heteroscedasticity. Residuals are normally distributed and function form is adequate

Table 4: Diagnostic Tests

Bruesch Godfrey (Serial Correlation LM Test	F-Statistic	0.199prob (0.824)
	Obs*R-sq	0.575prob. (0.749)
Bruesch-Pagan-Godfrey(Heterosked asticity Test	F-Statistic	1.063prob. (0.419)
	Obs*R-sq	10.728prob.(0.379)
Jarque_Bera(Normality Test)		0.632prob. (0.729)
Ramsey Reset Test	F-Statistic	1.945prob. (0.173)

Results of stability tests are reported in Figures 2 and 3. The CUSUM and CUSUM of Square fall within the critical bound. So, the parameters are stable and there is no breakpoint.

Figure 2: CUSUM

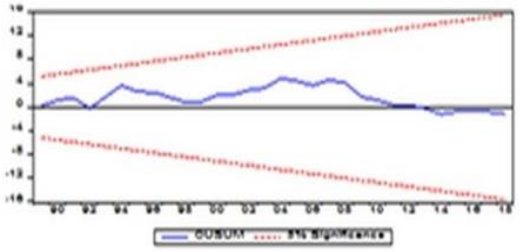
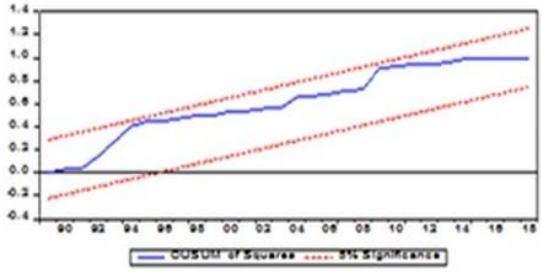


Figure 3: CUSUMSQ



5. CONCLUSION AND RECOMMENDATIONS

This study investigated whether FDI and trade openness are detrimental or beneficial for environmental quality in Pakistan over the period 1975–2019, using the ARDL bounds testing approach. The results confirm the co-integration between the variables. The feedback coefficient is negative and significant; indicating that disequilibrium in the previous years is adjusted at the speed of 0.59% in the current year. The findings disclose that FDI increases CO_2 in the SR as well as in the LR

which is consistent with PHH. Trade openness diminishes CO_2 in the LR and raises CO2 in the SR. The empirical results reveal that, both in LR and SR, FDI is detrimental for environment quality whereas trade openness improves environment quality in the LR and harmful in the SR. The results of the study endorse existence of EKC in Pakistan. The rationale behind validity of EKC can be the structural changes in economy, transformation from pre-industrial, industrial towards service oriented economy, awareness, stringent environmental standard and environment friendly technology over the time period.

CO2 emission is one of the important factors behind increased degradation of the environment. The quality of environment determines our quality of life. So, in the process of development of a country, environmental sustainability is as important as the social and economic sustainability. The policies that encourage socio-economic development have to be fine for the clean environment. The observation of this study proposed that the adoption of trade openness and FDI responsive strategies for the economic development in Pakistan may jeopardize the sustainability. To propagate sustainable development it become essential to introduce new environmental policies in the form of carbon-tax for excessive polluters and propose subsidies for environmental-friendly technologies. Along with the monetary benefits and detailed cost analysis it is also essential that the government should propose environmental benefits and cost audit of FDI inflows. Being a saving and capital deficient nation, The significance of FDI for economic development is incontestable in Pakistan regardless of environmental concerns. Thus, to balance between environment security and growth oriented benefits of FDI, policy makers in Pakistan need to focus on attracting green investments. In greening the economy of Pakistan, green finance can play a crucial role to move towards sustainability.

Due to the accessibility of data, CO_2 is used as a substitute for environmental degradation. Furthermore, the present research does not empirically scrutinize what are the transmissions mechanisms through which trade openness and FDI affect the environment. Analogous analysis that uses other pollutants as a proxy of environment degradation and inspects the transmission mechanism may produce noteworthy findings

REFERENCES

Acheampong, A. O., Adams, S., & Boateng, E. (2019). Do globalization and renewable energy contribute to carbon emissions mitigation in Sub-Saharan Africa? *Science of the Total Environment*, *677*, 436-446.

Ahmed, K. & Long, W. (2012). Environmental Kuznets Curve and Pakistan: An Empirical analysis. *Procedia Economics and Finance,1*, 4 – 13.

Alam, S., Redman, S., & Butt, M. S. (2011). Trade liberalization, environmental degradation and sustainable development in Pakistan. *European Journal of Social Sciences*, *19*(1), 84-96.

Alam, S., & Ahmed, Q. M. (2012). Exchange rate volatility and aggregate exports demand through ARDL framework: An experience from Pakistan economy. *Review of Applied Economics*, *8*(1), 79-94.

Amuka, J. I., Asogwa, F. O., Ugwuanyi, R. O., Omeje, A. N., &Onyechi, T. (2018). Climate change and life expectancy in a developing country: Evidence from greenhouse gas (CO2) emission in Nigeria. *International Journal of Economics and Financial Issues*, *8*(4), 113-119.

Antweiler, W., Copeland, B. R., & Taylor, M. S. (2001). Is free trade good for the environment? *American economic review*, *91*(4), 877-908.

Ali, L., Manzoor, A., &Yousaf, S. (2019). Contribution of Foreign Direct Investment in Economic Development of Pakistan: A Human Development Perspective. *Global Management Journal for Academic & Corporate Studies*, *9*(1), 50-64.

Aslam, A. L. M., &Sivarajasingham, S. (2020). Empirical relationship between workers' remittances and financial development (an ARDL cointegration approach for Sri Lanka). *International Journal of Social Economics*, *47*(11), 1381-1402.

Apergis, N., &Ozturk, I. (2015). Testing environmental Kuznets curve hypothesis in Asian countries. *Ecological Indicators*, *52*, 16-22.

Azhar, U., Khalil, S., & Ahmed, M. H. (2007). Environmental effects of trade liberalisation: A case study of Pakistan. *The Pakistan Development Review, 46*(4), 645-655.

Azam, M., & Khan, A. Q. (2016). Testing the Environmental Kuznets Curve hypothesis: A comparative empirical study for low, lower middle, upper middle and high income countries. *Renewable and Sustainable Energy Reviews*, *63*, 556-567.

Baek, J. (2016). A new look at the FDI–income–energy–environment nexus: dynamic panel data analysis of ASEAN. *Energy Policy, 91*, 22-27.

Bernard, J., & Mandal, S. K. (2016). The impact of trade openness on

environmental quality: an empirical analysis of emerging and developing economies. *WIT Trans Ecol Environ*, *203*, 195-208.

Cole, M. A., Rayner, A. J., & Bates, J. M. (1997). The environmental Kuznets curve: an empirical analysis. *Environment and development economics*, *2*(4), 401-416.

Copeland, B. R., & Taylor, M. S., &. (2003). Trade, growth and the environment. NBER Working Paper No. 9823.

Copeland, B. R. (2008). The pollution haven hypothesis. *Handbook on Trade and the Environment*. 60-70.

Copeland, B. R. (2010). How does trade affect the environment?Is Economic Growth Sustainable? (pp. 206-247). Palgrave Macmillan, London.

Davies, A., & Quinlivan, G. (2006). A panel data analysis of the impact of trade on human development. *The Journal of Socio-Economics, 35*(5), 868-876.

Economic Survey (2017-18). Islamabad: Finance Division, Economic Advisor's Wing, Government of Pakistan.

Falcone, P. M. (2020). Environmental regulation and green investments: The role of green finance. *International Journal of Green Economics*, *14*(2), 159-173.

Furtado, J. I. D. R., Belt, T., &Jammi, R. (Eds.). (2000). Economic development and environmental sustainability: Policies and principles for a durable equilibrium. The World Bank.

Gill, F. L., Viswanathan, K. K., & Karim, M. Z. A. (2018). The Critical Review of the Pollution Haven Hypothesis (PHH). *International Journal of Energy Economics and Policy*, *8*(1), 167-174.

Grossman, G. M., & Krueger, A. B. (1991). *Environmental impacts of a North American free trade agreement* (No. w3914). National Bureau of economic research.

Hakimi, A., &Hamdi, H. (2016). Trade liberalization, FDI inflows, environmental quality and economic growth: a comparative analysis between Tunisia and Morocco. *Renewable and Sustainable Energy Reviews*, *58*, 1445-1456.

Hakimi, A., &Hamdi, H. (2019). Environmental effects of trade openness: what role do institutions have? *Journal of Environmental Economics and Policy*, *9*(1), 36-56.

Halicioglu, F. (2009). An Econometric Study of CO2 Emissions, Energy Consumption, Income and Foreign Trade in Turkey. *Energy Policy* 37, 1156–1164.

Harrison, A. (1996). Openness and growth: A time-series, cross-country analysis for developing countries. *Journal of Development Economics, 48*(2), 419-447.

Hoekman, B. M. (2017). *Trade and the post-2015 development agenda* (No. 666). ADBI Working PaperSeries.

Helpman, E. (1998). Explaining the structure of foreign trade: Where do we

stand? *WeltwirtschaftlichesArchiv*, *13 4*(4), 573-589.

Hitam, M. B., &Borhan, H. B. (2012). FDI, growth and the environment: impact on quality of life in Malaysia. *Procedia-Social and Behavioral Sciences*, *50*, 333-342.

Haug, A. (2002). Temporal aggregation and the power of cointegration tests: A Monte Carlostudy. *Oxford Bulletin of Economics and Statistics*, 64, 399-412.

Huang, Y., Chen, X., Zhu, H., Huang, C., &Tian, Z. (2019). The Heterogeneous Effects of FDI and Foreign Trade on CO2 Emissions: Evidence from China. *Mathematical Problems in Engineering*, *2019*.

Jebli, M. B., Youssef, S. B., &Ozturk, I. (2016). Testing environmental Kuznets curve hypothesis: The role of renewable and non-renewable energy consumption and trade in OECD countries. *Ecological Indicators*, *60*, 824-831.

Khalil, S., &Inam, Z. (2006). Is trade good for Environment? A unit root cointegration analysis. *The Pakistan Development Review*. *45* (4) 1187-1196.

Khan, I., Iqbal, J., &Ullah, Z. (2019). Growth-Environment Nexus: Testing the Validity of the Environmental Kuznets Curve for the South Asian Economies. *FWU Journal of Social Sciences*, *13*(1), 155-166.

Kaur, K. (2007). The effects of environmental pollution on human health. World Affairs: *The Journal of International Issues*, *11(2)*, 22-43.

Lau, L. S., Choong, C. K., &Eng, Y. K. (2014). Investigation of the environmental Kuznets curve for carbon emissions in Malaysia: do foreign direct investment and trade matter?. *Energy Policy*, *68*, 490-497.

Le, T. H., Chang, Y., & Park, D. (2016). Trade openness and environmental quality: International evidence. *Energy policy*, *92*, 45-55.

Lopez, R. (1997). Environmental externalities in traditional agriculture and the impact of trade liberalization: the case of Ghana. *Journal of Development Economics*, *53*(1), 17-39.

Munir, S., & Khan, A. (2014). Impact of fossil fuel energy consumption on CO 2 emissions: evidence from Pakistan (1980-2010). *The Pakistan Development Review*, 327-346.

Narayan, P., & Smyth, R. (2005). Trade liberalization and economic growth in Fiji: An empirical assessment using the ARDL approach. *Journal of the Asia Pacific Economy*, 10(1), 96-115

Neequaye, N. A., &Oladi, R. (2015). Environment, growth, and FDI revisited. *International Review of Economics & Finance*, *39*, 47-56.

Onder, H. (2012). Trade and climate change: an analytical review of key issues (English).Economic premise; no. 86. Washington, DC: World Bank.

Ozturk, I., & Al-Mulali, U. (2015). Investigating the validity of the environmental Kuznets curve hypothesis in Cambodia. *Ecological Indicators*, *57*, 324-330.

Panayotou, T. (1993). *Empirical tests and policy analysis of environmental degradation at different stages of economic development* (No. 992927783402676). International Labour Organization.

Pasha, H.A. (2014). Economy of tomorrow: Case study of Pakistan. Friedrich Ebert Stiftung (FES) Pakistan.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), 289-326.

Ren, S., Yuan, B., Ma, X., & Chen, X. (2014). International trade, FDI (foreign direct investment) and embodied CO2 emissions: A case study of Chinas industrial sectors. *China Economic Review*, *28*, 123-134.

Riti, J. S., Sentanu, I. G. E. P. S., Cai, A., & Sheikh, S. (2016). Foreign direct investment, manufacturing export and the environment in Nigeria: A test of pollution haven hypothesis. *NIDA Development Journal*, *56*(2), 73-98.

Ruttan, Vernon W. 1971. Technology and the Environment. *American Journal of Agricultural Economics* 53: 707–17.

Saud, S., Chen, S., &Haseeb, A. (2019). Impact of financial development and economic growth on environmental quality: an empirical analysis from Belt and Road Initiative (BRI) countries. *Environmental Science and Pollution Research*, *26*(3), 2253-2269.

Seker, F., Ertugrul, H. M., & Cetin, M. (2015). The impact of foreign direct investment on environmental quality: a bounds testing and causality analysis for Turkey. *Renewable and Sustainable Energy Reviews*, *52*, 347-356.

Shaari, M. S., Hussain, N. E., Abdullah, H., &Kamil, S. (2014). Relationship among Foreign direct investment, economic growth and co2 emission: a panel data analysis. *International Journal of Energy Economics and Policy*, *4*(4), 706.

Shahbaz, M., Lean, H. H., &Shabbir, M. S. (2012). Environmental Kuznets curve hypothesis in Pakistan: co integration and Granger causality. *Renewable and Sustainable Energy Reviews*, *16*(5), 2947-2953.

Shahbaz, M., Nasreen, S., Abbas, F., &Anis, O. (2015). Does foreign direct investment impede environmental quality in high-, middle-, and low-income countries? *Energy Economics*, *51*, 275-287.

Shahbaz, M., Balsalobre-Lorente, D., & Sinha, A. (2019). Foreign direct Investment–CO2 emissions nexus in Middle East and North African countries:

Importance of biomass energy consumption. *Journal of cleaner production*, *217*, 603-614.

Shahbaz, M., Gozgor, G., Kofi Adom, P., &Hammoudeh, S. (2019). The Technical Decomposition of Carbon Emissions and the Concerns about FDI and Trade Openness Effects in the United States. *University Library of Munich,* Germany.

Shahbaz, M., Loganathan, N., Sbia, R., &Afza, T. (2015). The effect of urbanization, affluence and trade openness on energy consumption: A time series analysis in Malaysia. *Renewable and Sustainable Energy Reviews*, *47*, 683-693.

Shahbaz, M., Tiwari, A. K., & Nasir, M. (2013). The effects of financial development,

economic growth, coal consumption and trade openness on CO2 emissions in South Africa. *Energy Policy*, *61*, 1452-1459.

Speldewinde, P. (2006). Environmental degradation and human health in Western
Australia. *Epidemiology*, *17*(6), S435.

Stern, N. (2009). A blueprint for a safer planet: How to manage climate change and create a new era of progress and prosperity. *Random House*. (1):1-25.

Strutt, A., & Anderson, K. (2000). Will trade liberalization harm the environment? The case of Indonesia to 2020. *Environmental and Resource Economics*, *17*(3), 203-232.

Sun, H. P., Tariq, G., Haris, M., &Mohsin, M. (2019). Evaluating the environmental effects of economic openness: evidence from SAARC countries. *Environmental Science and Pollution Research*, 1-10.

Tariq, G., Sun, H., Haris, M., Kong, Y., &Nadeem, A. (2018). Trade liberalization, FDI inflows economic growth and environmental sustainability in Pakistan and India. *Journal of Agriculture and Environment for International Development (JAEID)*, *112*(2), 253-269.

Umar, M., &Asghar, Z. (2018). SDG Index for Pakistan at Provincial Level. MPRA Paper No. 83997. Retrieved from https://mpra.ub.uni-muenchen.de/83997/

Wang, Y., & Zhao, T. (2015). Impacts of energy-related CO2 emissions: evidence from under developed, developing and highly developed regions in China. *Ecological Indicators*, *50*, 186-195.

World Bank (2019). *World Development Indicators*. http://databank.worldbank.org

World Bank. 2020. “DataBank The World Bank.” Retrieved May 14, 2020 (https://databank.worldbank.org/home.aspx).

Yandle, B., Vijayaraghavan, M., &Bhattarai, M. (2002). The environmental Kuznets curve. *A Primer, PERC Research Study*, 02-01.

Yu, C., Nataliia, D., Yoo, S. J., & Hwang, Y. S. (2019). Does trade openness convey a positive impact for the environmental quality? Evidence from a panel of CIS countries. *Eurasian Geography and Economics*, *60*(3), 333-356.

Zheng, J., & Sheng, P. (2017). The impact of foreign direct investment (FDI) on the environment: market perspectives and evidence from China. *Economies*, *5*(1), 8.

Zhang, S. (2018). Is trade openness good for environment in South Korea? The role of non-fossil electricity consumption. *Environmental Science and Pollution Research*, *25*(10), 9510-9522.

Zhang, S., Liu, X., &Bae, J. (2017). Does trade openness affect CO 2 emissions: evidence from ten newly industrialized countries? *Environmental Science and Pollution Research*, *24*(21), 17616-17625.

Zugravu-Soilita, N. (2017). How does foreign direct investment affect pollution? Toward a better understanding of the direct and conditional effects. *Environmental and Resource Economics, 66*(2), 293-338.