Is Trade Openness Good or Bad for Environment in Pakistan; an ARDL Bounds Testing Approach

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Abstract. This study explored the relationship between trade openness, foreign direct investment, GDP, and environmental quality in Pakistan by using time series data for time period of 1971-2016.To examine long-run and short-run association among projected variables, we employed autoregressive distributed lag ARDL-bounds testing approach. The findings of the study confirmed a positive and significant long run association between trade openness, foreign direct investment, and environmental degradation in Pakistan. However, there is no relationship between GDP and environmental quality. Policymakers must consider environmental degradation due to trade openness and FDI; further environmental quality should not be ignored. The government must enforce environmental laws on local and international organizations.

Introduction

The worldwide environmental concerns due to adverse climate changes over planet earth have tended world economies towards the use of green energy along with considerable reduction in CO_2 emission [1]. According to the recent studies, the large part of carbon emission is coming from the developing economies due to rapid economic growth. The globalization, where it benefits the developing economies to nurture their economies through reduced investment and trade barriers, opening of technology transfer, and mobilized capital and labor [2].

To investigate the real impact of trade on environment, various studies haveanalyzed the dynamic relationship between trade liberalization, energy usage and economic growth. Most of the researchers agreed at first that trade liberalization has improved allocation of domestic resources. Some studies found that liberalization of trade reduced pollution and decreased the use of energy efficiency. For example, the study by Sbia et al.[3] found that liberalization of trade enhanced the flows of new technology which substituted the old technology profoundly overwhelming the use of energy. Conversely, some studies found that liberalization of trade has deteriorated the environmental quality. The study by Lopez [4] shows that trade liberalization was tailed by an escalation in energy-based-events such as manufacturing and transportation that devour heavy energy and yield pollution.

The aim of this research is to investigate the economic impacts of the trade openness on the environmental quality in Pakistan. Specifically, the paper inspects whether openness of the trade has harmed the quality of the environment in Pakistan. For empirical results, we used ARDL approach for short run and long run.

The structure of the paper is as follows: Section 2 reviews the existing literature on the subject. Section 3 presents the model, methodology and data. Section 4 presents the empirical results and also discussion. The last section concludes the study.

Literature Review

The correlation concerning trade liberalization, economic growth and the environmental quality has gained significant interest by scholars and policy makers during the last decade. Former studies classified this relationship in three categories. The first category is the scale effect in which trade openness is thought to fuel the domestic consumption and the level of production and hence speed up the economic activity. The second category is the technical effects which recommend that trade liberalization delivers the prospects of the transfer of advanced technology and reinforces the environmental regulation. The third category is the composition effect which acts when trade impacts on modeling the economic structure of the host country [5].

The impact of trade on the environmental quality has currently gained special consideration by scholars and policymakers. Essentially, the liberalization of the trade sector has directed to an extension of the international exchange events and the rush of FDI in manufacturing and energy-consuming sectors. As a result, the use of energy increased drastically, pollutant emissions surged and the environmental quality degenerated. All these factors have augmented the susceptibility of the ecosystem specifically in developing countries [6].

According to Aplay [7], the inconsistency of the consequence between the countries is based on many country-specific factors such as progress level of the countries, their comparative advantage, the resource intensity of the traded product, current level of environmental awareness, and the existence of environmental policies. Environmental economists including Grossman and Krueger [5], Bhagwati [8], Panayotou [9], Selden andSong [10], Grossman and Krueger [11], Ferrantino [12], Antweiler et al. [13], Ferrantino andLinkins [14], and Tsai [15] propose a positive relationship between free trade, economic growth and environmental policies. These authors discoursed that trade liberalization leads to a rise in welfare derived from a better allocation of domestic resources. In another opinion, ecological economists including Lopez [4], Cole et al. [16], Strutt and Anderson [17], disapproved the norms developed by environmental economists and recommend that trade liberalization will spawn negative environmental externalities especially when rich countries invest in dirty industries in host countries.

The studies which show trade openness influences negatively include; Suri and Chapman [18], Schmalensee et al [19]; Beghin et al [20]; Abler et al [21]; Lopez [22]; Cole et al [23] and Antweiler et al., [13]; Copeland and Taylor [24]; Chaudhuri and Pfaff, [25]; Ozturk and Acaravci [26] Nasir and Rehman [27], but it is also assumed that trade openness also helps to stand the negative effect in helping the economy pursued technology to achieve the efficiency, and after certain level of growth, the environmental degradation is also declined. Therefore, the mix results are found in literature regarding the impact of trade openness on fluctuating environmental quality.

Methodology

The Data, Model and Methodology of the Study

In this study, we used the following variables: trade openness (TOP), FDI, GDP and carbon dioxide (CO_2) emissions. CO_2 emissions (measured in metric ton) are used as a proxy for environmental quality. Trade openness measures are used in this study such as trade volumes (import + export) as a share of GDP ratio. We also used the GDP and FDI inflow to CO_2 as control variables. The yearly time series covers the period from 1971 to 2016. The main source of our data is provided by the World Bank [28]. All variables are transformed into log form. In this study, ARDL bound testing approach is applied to examine the effect of trade openness (TOP) on environmental quality.

Econometric Mode

$$CO2_t = \beta_0 + \beta_1(TP_t) + \beta_2(FDI_t) + \beta_3(GDP_t) + u_t \tag{1}$$

Where CO_2, TP, FDI and GDP refers to CO_2 emissions, trade openness, foreign direct investment and gross domestic product respectively. While, $\beta_1, \beta_2, and \beta_3$ are long run parameters. More importantly, traditional cointegration approaches by Engle and Granger [29], Johansen [30, 31], and

Johansen-Juselius [32] have a precondition that all the variables must be stationary at I(1) and one limitation of the mentioned approaches was that these cointegration tests perform poor in small sample size, therefore, to overcome said limitation, we employed ARDL approach advanced by Pesaran, Shin and Smith [33], Pesaran and Shin [34], and Pesaran et al. [35]. For the ARDL model, stationary checking is not required, but ARDL approach can be applied in the presence of I(2) variable, because in the presence of I(2) or above, variables computed f-statistics are not valid [36].

Taking into account of benefits of ARDL model, we specified following ARDL long run equation, however, in Equation 1 we can only find long run coefficients while for long run and short run coefficient, we formulated following ARDL equation.

$$\Delta CO2_t = \theta + \sum_{k=1}^{P1} \theta_k \, \Delta CO2_{t-k} + \sum_{k=1}^{P2} \theta_k \, \Delta TP_{t-k} + \sum_{k=1}^{P3} \theta_k \, \Delta FDI_{t-k} + \sum_{k=1}^{P4} \theta_k \, \Delta GDP_{t-k} +$$
$$\lambda_1 CO2_{t-1} + \lambda_2 TP_{t-1} + \lambda_2 FDI_{t-1} + \lambda_3 GDP_{t-1} + \mu_t \qquad (2)$$

Empirical Findings

Before testing long run association among projected variables, we checked unit root of the series and it is confirmed that there was no variables stationary at I(2). Therefore, we could test either long run exists or not between CO_2, TOP, FD and GDP, Table 1 includes unit root results. Furthermore, bounds test results showed that cointegration exists in purposed variables. F-statistic value was 6.6088 that was higher than upper bound value which was 5.0700.

Table 1. Unit Root Test (ADF) Results

Variable s	Unit root at level I(0)	Unit root at first difference I(1)
LnCO$_2$	1.1995 (0.9392)	-1.958 (0.0488)
LnTOP	-3.2124 (0.0253)	-9.0357 (0.0000)
LnFDI	-1.7858 (0.0706)	-4.4760 (0.0000)
LnGDP	.1746 (.9000)	- 4.7425 (0.0003)

Table 2. ARDL Model Long -run Results

Variables	Long run parameters Coefficients (prob)	Short run parameters Coefficients (prob)
LnTOP	1.0833 (0.0609)***	0.2205 (0.0026)*
LnFDI	0.1752 (0.0105)**	0.0130 (0.2193)
LnGDP	-0.3050 (0.2488)	-0.0621 (0.3105)
C	10.1398 (0.1018)	--------------
@TREND	0.0462 (0.0279)**	0.0094 (0.1352)

Note: Error correction term is *-0.204*, Jarque- Bera *0.121**, Breusch-Godfrey Serial Correlation LM Test 0.441**, and Heteroscedasticity 0.312**

*, **, & *** refer to significance at 1%,5% and 10% respectively*

Table 2 showed the results of long run and short run parameters. The findings of the study showed that there is a positive and significant association between trade openness, FDIand environmental degradation. It impliedthat in a long run, due to increase in trade openness and FDI, there wassurge in

environmental degradation/damage. While GDP showedno significant link with environmental degradation in long run as well as in short-run. The findings of the study werealigned with Grossman and Krueger [11], and Hakimi and Hamdi [6]. Furthermore, the error correction term wastelling 20% speed of adjustment in each year. While, we also employed different diagnostics test such as normality test, serial correlation test and Heteroscedasticity test, and it wasfound that the model surpassed all the major issues so we couldrely on the ARDL calculated results. Finally, we also tested parameters stability with the help of CUSUM and CUSUMsq tests as showed in Figure 1. Moreover, both testsconfirmed that parameters werestable, and there wasno problem of possible structural breaks.
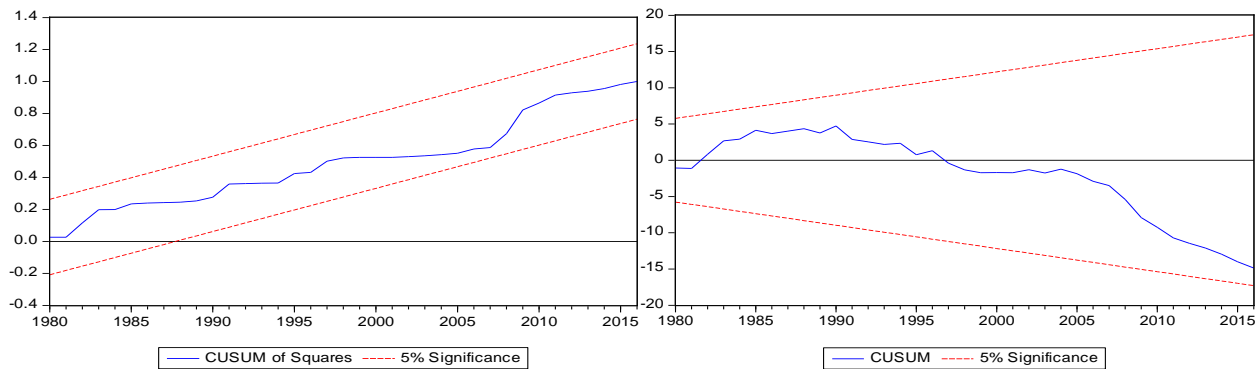

Figure 1: CUSUM and CUSUMsq Tests Showing Parameters Stability

Conclusions

This study explored the relationship between trade openness, FDI, GDP and environmental quality in Pakistan by using time series data for the time period of 1971-2016. To examine the long-run and short-run association among projected variables, we employed autoregressive distributed lag ARDL-bounds testing approach. The findings of the study confirmed a positive and significant long run association between trade openness, FDI, and environmental degradation in Pakistan. The policy makers must consider environmental issues into account for the betterment of human lives. The government must enforce environmental laws on local and international organizations.

Conflict of interest: The authors declare that there is no conflict of interest.

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