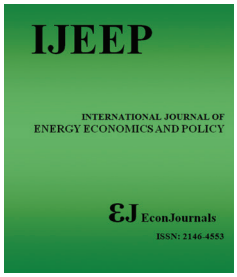

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Agricultural Exports, Financial Openness and Ecological Footprints: An Empirical Analysis for Pakistan

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ABSTRACT

The environmental degradation has become one of the most debatable issues in 21st century. The current study explores the impact of agricultural exports and financial openness on ecological footprints in Pakistan. For this purpose, the study utilizes time series data. Unit root tests are applied to check the data for unit root problem and autoregressive distributed lagged (ARDL) model is employed for cointegration analysis. The results of the study show that agriculture exports are responsible for lessening ecological footprints in long run as well as in short run thus; increase in agricultural exports will restrain environmental degradation in Pakistan. The results also revealed that financial openness increases ecological footprints henceforth, environmental degradation in Pakistan. Moreover, trade openness, economic growth and energy consumption are also significant factors of ecological footprints.

Keywords: Agricultural Exports, Financial Openness, Ecological Footprints, Pakistan
JEL Classifications: C22, E01, F18, Q57

1. INTRODUCTION

The geographical scope of environmental policies has become a debate with concerns, it has widened over the period of last few decades. Most of the environmental problems and obstacles are need to be tackled by more than one nation as it has become a global concern (Vogel, 2000). In today's era of globalization, international trade plays a vital role in the relative growth of economies and also it has significantly grown in recent decades. This growth in trade across the boarders has led environmental concerns in both exporting and importing nations. The trade does enhances the economic welfare but this notion becomes in veil when environmental degradation lowers that welfare (Huang and Labys, 2002). Policy disputes over the international trade and environment has led some indifferent conceptions regarding the impact of the international flows on environmental situations. Some policies depicted that the international trade leads to economic growth, after reaching a suitable level of income the nation will start spending in order to encounter the environmental problems, so the environmental gain and loss will be equal (Gallagher, 2009).

Environmental degradation refers to pollution of air, water and soil. It harms the components of environment like mountains, forests, water and other natural resources; on which all the living beings are dependent. This degradation in environment lays a long term effect on human life (Rehman and Zeb, 2020). Ecological footprints is the quantification of how much water and land is required to produce the commodities that are consumed also includes the assimilations of wastes that are produced by the commodities (Jorgenson, 2003). Ecological footprints are considered as a suitable measure for the assessment of the environmental degradation (Liu et al., 2018).

Pakistan faces the problem of deforestation and also one of the most climate change affected country of the world. Its economy is largely dependent upon the agricultural sector which is a dominant factor in the growth, provides raw material to industry and employs around 40 % of labor force. Agricultural exports mostly composed of unprocessed and processed agricultural goods. However, agricultural exports impact on environment received attention from researchers as agricultural exports has an indirect effect on environmental degradation as it leads to the deforestation and soil erosion (Balogh and Jámbor, 2020). Besides, openness of a country depends on trade and financial flows and these components are being considered important factors of environmental degradation in empirical research and their impact on environment is not settled as it may improve or deteriorate environment quality. However, Koengkan et al. (2018) argued that financial openness increases the loan supply and decreases the loan cost, this manipulates the investment and consumption by the firms and results in increasing the demand for fossil fuels thus; financial openness leads to environmental degradation. In short the increase in the financial flow in a country enhances the production of non-environmental commodities and energy consumption practices thus that negatively contributes to the environment (Aydin and Turan, 2020). Thus; this study is designed to capture the impact of agricultural exports and financial openness on ecological footprints in Pakistan. These two objectives make this study unique for Pakistan as researchers did not come across any study that examine effect of agricultural exports and financial openness on ecological footprints.

2. LITERATURE REVIEW

Agriculture and industry are considered as core sectors of the economy that provides inputs and outputs for each other. However, agriculture sector is a primary sector of the economy that plays an important role in uplifting economy, responsible for structural transformation and helped many countries across the world to reduce poverty (Cervantes-Godoy and Dewbre, 2010). Moreover, almost more than 50% of world population live in rural areas where agriculture sector is main source of livelihood. However, the agriculture sector is now facing various challenges due to agriculture base economic growth for poverty alleviation, biodiversity, ensuring the food security and above all, the negative impact of agriculture sector on environment and climate change (Anton et al., 2012) as pointed out by Pachauri et al. (2014) that agriculture and forestry including other land use is accounted for one fourth of global greenhouse gases henceforth for environmental degradation across the globe. Besides, some of the researchers highlighted the reasons for the negative impact of agriculture sector on environment is deforestation, rice cultivation, livestock rearing, use of chemicals in fertilizers, waste and landfills (Jovanovi_c et al., 2015; Das et al., 2017; Forabosco et al., 2017).

In certain cases, agricultural trade has a positive impact on the environment and it can help reduce the environmental degradation. According to Carter (1993) stated that the trade of food products from rich to poor countries leads to the reduction of world's agricultural pollution hence the trade of agricultural products is considered to be beneficial for the environment. This study was followed by Hassan (1997) who stated the trade liberalization of agriculture products has a positive and advantageous effect on environment as the production of agriculture goods are associated with positive environmental externalities. Contrary, Alassane (2011) opined that trade influence environmental degradation through various channels and the association between trade and environmental degradation is being studied theoretically as well as empirically. However, trade has many components and each component of trade did not receive enough attention from researchers. Henceforth, he conducted a panel study to examine effect of agricultural exports on environmental degradation over period from 1991 to 2009. The results of his study documented that agricultural exports are responsible for environmental degradation. Moreover, his study concluded that trade induced environmental degradation badly affecting population's health.

Zambrano-Monserrate et al. (2018) carried out study to determine the effect of agricultural exports on environmental degradation in five European countries (France, Germany, Greece, Portugal and Turkey). They used deforestation as indicator of environmental degradation and analyzed time series data from 1974 to 2013 through autoregressive distributed lagged (ARDL) model. This study examined the effect of agricultural exports on environmental degradation in environmental Kuznets curve hypothesis and found that variables of the study are cointegrated in the long run. Moreover, results of the study revealed that environmental Kuznets curve hypothesis exists in France, Germany, Portugal and Turkey whereas U-shaped relationship is found between per capita income and environmental degradation in Greece. Besides, the results of the study showed that agricultural exports are responsible for environmental degradation in Greece. However, agriculture sector is not always negatively associated with environment as Balogh and Jámbor (2020) in their review study came up with suggestion that agricultural exports can be environmental friendly as it can reduce environmental degradation.

Empirical research studies also highlighted the impact of financial openness on environmental degradation. For instance, Koengkan et al. (2018) conduted a study with the aim of estbalishing a relation of financail openness and environmental degradations for MERCOSUR countries. The study employed a panel data for the period of 1980-2014 which was analyzed under a panel autoregressive distributive lag (PARDL) model in the form of unrestricted error correction model. The results of short run and elasticities of Panel ARDL reveavled that the financial openness does increase the environmental degradation for all the MERCOSUR countries. The study also revealed economic growth, energy and agriculture production also lead to environmental degradation. The study suggested that policy makers have to change the way of energy mix is financed in MERCOSUR countries.

Koengkan et al. (2018) conducted their study to analyze impact of financial openness, trade openness, economic growth and energy consumption on environemtnal degradation in context of Latin American and Carribean countries. In this study, long run and short run estimates are obtained through ARDL model. Results of the study showed that financial openness, primary energy consumption

and economic growth aggrevated envrionmental degradation in short run as well as in long run whereas renewable energy has restrianed environmental degradation. Likewis, Aydin and Turan (2020) conducted a study which aimed to find the impact of economic growth, financial openness, trade openness and energy intensity on ecological footprints for BRICS countries. The study used a panel data for the period of 1996-2016 and established three models in order to analyze the effect of financial openness and trade openness on environmental degradations as a whole and on individual basis as well for each of the countries. The results of the study revealed that financial openness reduced the environmental degradation in India and South Africa but for other countries this relation was opposite, furthermore trade openness showed a negative relation with environmental degradation for India and China. Likewise, the results of the study it was revealed that energy intensity increases the environmental degradation for all the BRICS countries except China.

It can be deduced from past empirical literature that agricultural exports (AGX) and financial openness (FO) along with trade openness (TO), economic growth (GDP) and energy consumption (EC) are significant factor of environmental degradation and according to Liu et al. (2018) ecological footprints (EF) is an appropriate proxy of environmental degradation. Henceforth, this the reason that this study has also considered ecological footprints as a proxy for environmental degradation. Thus, empirical model of the study is depicted in Equation (1) below:

$$EF=f(AGX,FO,TO,GDP,EC) \quad (1)$$

3. MATERIALS AND METHODS

In order to achieve objectives of the study, this study will analyze time series data. As mentioned earlier that this study will proxy environmental degradation with ecological footprints so data on ecological footprints is collected from Ecological Footprint Network online database. Agricultural exports are taken as a percentage of merchandise exports and financial openness is proxy with ratio of net flows of foreign direct investment (FDI) to GDP. This study uses GDP as a proxy for economic growth that is measured in constant US Dollars. Energy use measured kilo grams of oil equivalent per capita is used as a proxy for energy consumption. Data on agricultural exports, trade openness, GDP and energy consumption is taken from World Bank online database (World Bank, 2021). The study uses Autoregressive distributive lag (ARDL) model developed by Pesaran and Shin (1999) in order to check the long run cointegration among variables of the study, but prior to that the study uses the Augmented Dicky Fuller test (Dickey and Fuller, 1979) and Phillips-Peron test (Phillips and Perron, 1988) in order to check the unit root in the time series. The general representation of the ADF and PP unit root test is given below:

$$\Delta Y_t = \alpha_1 + \sum_{j=1}^{n} \varnothing \Delta Y_{t-j} + e_t \quad (2)$$

The hypothesis is tested through the statistical probability value of "∅", the following hypothesis are tested for the unit root analysis. The null hypothesis is that there is unit root (data is non-stationary) while alternative hypothesis is that there is no unit root (data is stationary). Once unit root problem is identified and solved (if any) then ARDL model will be used for cointegration analysis. It tells both the long and short run relationships of the variables and another convenience of the ARDL model is that it can consider variables for the analysis with different level of integrations. The empirical model in Equation (1) will be through ARDL specification as depicted in Equation 3 as follows:

$$\begin{aligned}\Delta lnEF_t =& \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta lnEF_{t-i} + \sum_{j=0}^{n} \beta_{2j} \Delta lnAX_{t-j} + \sum_{k=0}^{q} \beta_{3k} \Delta lnFO_{t-k} \\ &+ \sum_{p=0}^{o} \beta_{4p} \Delta lnTO_{t-p} + \sum_{l=0}^{h} \beta_{5l} \Delta lnGDP_{t-l} + \sum_{g=0}^{V} \beta_{6G} \Delta lnEC_{t-g} \\ &+ \varphi_1 lnEF_{t-1} + \varphi_2 lnAX_{t-1} + \varphi_3 lnFO_{t-1} + \varphi_4 lnTO_{t-1} \\ &+ \varphi_5 GDP_{t-1} + \varphi_6 EC_{t-1} + \pi ECT_{t-1} + u_t \end{aligned} \quad (3)$$

Where "β_0" is the intercept term; β_1, β_2, β_3, β_4, β_5 and β_6 are the short run coefficients and ϕ_1, ϕ_2, ϕ_3, ϕ_4, ϕ_5, and ϕ_6 are the long run coefficients. The ECT term shows the adjustment effect and the significance of its coefficient π will show the dynamic stability of the overall model. All variables are taken in natural log to take care of heteroscadasticity at initial stage of the analysis. The description of variables is presented in Table 1.

4. RESULTS AND DISCUSSION

Table 2 depicts the descriptive analysis of the variables used in current study. The dependent variable is the ecological footprints which is a suitable measure for the environmental degradations, the Table shows that on average from 1975 to 2015 the ecological prints in Pakistan are estimated as 0.40 hectare while its maximum value is 0.53 hectare. The average agricultural exports are 7.27% of merchandize exports with 20.47 and 1.22% as its maximum and minimum values respectively. Financial openness has a mean value of 0.83 with 3.35 and 0.17 as its maximum and minimum values respectively. Trade openness has maximum and minimum value of 38.50 and 25.36 respectively and its mean during study period is 32.87. The energy use on average for Pakistan is 407.88 kg while

Table 1: Variable description

Variables	Abbreviations	Description
Dependent variable		
Ecological footprints	*EF*	Measured in global hectare (GHA)
Independent variables		
Agriculture export	*AX*	Percentage of merchandise exports
Financial openness	*FO*	Ratio of net inflows of FDI to GDP
Trade openness	*TO*	Percentage of total GDP
GDP	*GDP*	Obtained by dividing the total GDP on population
Energy use	EC	Annual consumption of energy measured in kilo grams of oil per capita

the itx maximum value is 500.43 kg. The Jarque-Berra (JB) statistic shows that some of the variables of the study are not normally distributed however; after taking natural log all variables of the study are normally distributed.

Further the variables are checked for the unit root through Augmented Dicky Fuller test (Dickey and Fuller, 1979) and Phillips Peron test (Phillips and Perron, 1988). Table 3 shows the result of both ADF and PP tests for unit root, the obtained results shows that as like most of the time series data all the variables are stationary at first difference. Both of the ADF and PP tests have yielded same results. Now the variables can be tested for the long run co-integrations.

The study used the ARDL model in order to find out the long run cointegration of environmental degradations with export compositions, financial innovation and other control variables in the model. Table 4 depicts the results of ARDL bound test which confirms the hypothesis that the variables are cointegrated in long run as the F- Statistical value is greater than the upper bound values for 10% level of significance. This result shows that all the included variables of the study are in long run relation and agricultural exports and financial openness are determinants of environmental degradation along with trade openness, economic growth and energy consumption in Pakistan.

Table 5 contains both long run and short run results. All explanatory variables are found to have significant effect on ecological footprints except trade openness. Agricultural exports are negatively associated with ecological footprints in long run as well as in short run. This finding resemble with study conducted by Balogh and Jámbor (2020) who concluded that effect of agricultrual exports on environmental degradation is negative. From this result, it can be deduced that Pakistan has to encourage agricultural productivity through subsidizing fertilizer cost, improve seed quality through research, provide agricultural credit to farmers and encourage agricultural exports. This will enable Pakistan to enahnce exports on one hand and can less climate change affects as increase agricultural exports will reduce ecological footprints. Since 1980s, for most of years in agriculture sector, Pakistan is net exporter however, since 2018, Pakistan is net importer in agricultural sector. This means that in recent past, govt. of Pakistan ignored agricultural sector and consequently, less labor force is being employed in agriculture than before. Henceforth, the share of agricultural exports in mechandize exports shrinked and this one of the reason that for last ten years total exports of Pakistan fluctuate around USD 20 billion. If Pakistan wants to enahnce its total exports it must encouarge agricultural sector as Pakistan's economy is backed by agriculture and textile exports constitutes more than 70% of total exports.

The second objective of the current study was to establish a link between financial openness and environmental degradation. The study its second objective as well, results shows a positive and a significant effect of financial openness on ecological footprints. This result can be interpreted as increase financial openness of Pakistan causes the environmental degradation. This finding of the study was previously confirmed by Koengkan et al. (2018) as their study conclude that financial openness increases the environmental degradation in developing countries such is the case found here

Table 2: Descriptive statistics

Variables	*EF*	*AX*	*FO*	*TO*	*GDP*	*EC*
Mean	0.40	7.27	0.83	32.87	1.03E+11	407.88
Maximum	0.53	20.47	3.35	38.50	2.06E+11	500.43
Minimum	0.30	1.22	0.17	25.36	3.19E+10	299.11
Std. Dev.	0.07	5.80	0.80	3.18	5.20E+10	63.39
JB	3.19	3.82	58.10	1.58	2.74	3.66
Prob.	0.20	0.15	0.00	00	0.24	0.16
Variables	***lnEF***	***lnAX***	***lnFO***	***lnTO***	***lnGDP***	***lnEC***
JB	3.52	3.98	0.14	3.15	2.42	4.12
Prob.	0.17	0.14	0.93	0.21	0.30	0.13
Observations	40	40	40	40	40	40

Source: World bank (2021)

Table 3: Results of unit root tests

Augmented Dickey Fuller test					
Variables	**Trend and intercept (At level)**		**Trend and intercept (1st difference)**		**Integration**
	t-statistics	**Probability**	**t-statistics**	**Probability**	
lnEF	−1.64	0.5164	−8.36*	0.00	I(1)
lnAX	−1.20	0.66	−11.05*	0.00	I(1)
lnFO	−1.84	0.36	−6.24*	0.00	I(1)
lnTO	−2.03	0.27	−6.53*	0.00	I(1)
lnGDP	−3.49**	0.01	--	--	I(0)
lnEC	−2.64	0.26	−4.91*	0.00	I(1)
Phillips Peron Test					
Variables	**Trend and Intercept (At level)**		**Trend and Intercept (1st difference)**		**Integration**
	t-statistics	**Probability**	**t-statistics**	**Probability**	
lnEF	−1.79	0.38	−8.02*	0.00	I(1)
lnAX	−1.28	0.3191	−11.05*	0.00	I(1)
lnFO	−1.90	0.33	−6.22*	0.00	I(1)
lnTO	−2.16	0.22	−6.55*	0.00	I(1)
lnGDP	−3.01**	0.01	--	--	I(0)
lnEC	−1.94	0.31	−4.99*	0.00	I(1)

* and **Show significant levels of 1% and 5% respectively

Table 4: ARDL bound test

F-Statistical = 3.60***		
Level of significance	**Lower bound I(0)**	**Upper bound I(1)**
1%	3.41	4.68
5%	2.62	3.79
10%	2.26	3.35

***Shows significance at 10 % level

Table 5: Results bases on ARDL

Variables	Coefficients	Std. error	Probability
Long run results			
lnAX	−0.03**	0.01	0.03
lnFO	0.04**	0.01	0.01
lnTO	−0.07*	0.50	0.00
lnGDP	0.12**	0.04	0.01
lnEC	0.69*	0.17	0.00
Constant	−7.92*	0.50	0.00
Short run results			
D(lnAX)	−0.03**	0.01	0.04
D(lnFO)	0.04**	0.01	0.01
D(lnTO)	−0.07	0.08	0.38
D(lnGDP)	0.13**	0.05	0.02
D(lnEC)	0.20	0.31	0.53
ECT	−1.05*	0.17	0.00

*, **, ***Show significant levels of 1%, 5% and 10% respectively

for Pakistan in the current study. One of the reason for this finding is that most of foreign investment in Pakistan comes in energy sector followed by financial markets and institutions that provide most of private credit to industry rather than agriculture sector.

This study found that trade openness has significant negative effect on ecological footprints in long run whereas economic growth has positive and significant effect on ecological footprints not only in long run but also in short run. This implies that Pakistan's economy is growing at the expense of environmental degradation. Additionally, energy consumption is significant contributor of ecological footprints in long run as Pakistan is fulfilling above 60 percent from fossil fuel and the share of renewable energy is minute. Thus; Pakistan can improve environmental degradation by enhancing share of hydro in electricity as it is <30% and by enhancing the share of renewable energy in total energy. However; instead of increasing share of renewable energy, Pakistan in recent past initiated coal projects that will further worsen environmental quality and it will be difficult for govt. of Pakistan to lessen effect of climate change as Pakistan is in top ten most climate change affected country. Besides, short run and long run estimates, the important point about results of ARDL is that it also shows whether estimated model is dynamically stable or not. This dynamic stability of the model is captured through negative and significant coefficient of ECT that shows model is dynamically stable and will adjust to any external shock within a year.

5. CONCLUSIONS AND POLICY IMPLICATIONS

The current study explores the impact of agricultural exports and financial openness on environmental degradations in Pakistan. For the purpose the study employees a time services data for the period of 1975-2015. The study applied ARDL approach for cointegration after integration of the time series variables is being determined. All variables of the study are cointegrated in long run and it can be deduced from long run cointegration result that agricultural exports, financial openness, trade openness, economic growth and energy consumption are determinants of ecological footprints in case of Pakistan. Results of the study show that agricultural exports are lessening ecological footprints whereas financial openness are leading to more ecological footprints. Likewise, trade openness is restraining ecological footprints whereas economic growth is increasing ecological footprints in Pakistan. The effect of energy consumption on ecological footprints is significant and positive in long run while its effect is insignificant in short run. Moreover, this study finds that model of the study is dynamically stable and model will adjust itself within a year from any external shock.

It can be deduced that Pakistan has to encourage agricultural productivity through subsidizing fertilizer cost, improve seed quality through research, provide agricultural credit to farmers and encourage agricultural exports. This will enable Pakistan to enahnce exports on one hand and can lessen climate change affects as increase agricultural exports will reduce ecological footprints. Since 1980s, for most of years in agriculture sector, Pakistan is net exporter however, since 2018, Pakistan is net importer in agricultural sector. This means that in recent past, govt. of Pakistan ignored agricultural sector and consequently, less labor force is being employed in agriculture than before. Henceforth, the share of agricultural exports in mechandize exports shrinked and this one of the reason that for last ten years total exports of Pakistan fluctuate around USD 20 billion. If Pakistan wants to enahnce its total exports it must encouarge agricultural sector as Pakistan's economy is backed by agriculture and textile exports constitutes more than 70% of total exports. On other hand, financial openness is responsble for environemntal degradation in Pakistan, reason for this finding is that most of foreign investment in Pakistan comes in energy sector followed by financial markets and institutions that provide most of private credit to industry rather than agriculture sector. Similarly, this study found that energy consumption is also responsible for environmental degradation so, Pakistan can improve environmental quality by enhancing share of hydro in electricity as it is less than 30% and by enhancing the share of renewable energy in total energy. However; instead of increasing share of renewable energy, Pakistan in recent past initiated coal projects that will further aggravate environmental degradation.

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