Does Financial Liberalization Affect Environmental Degradation (CO_2 Emission and Ecological Footprints)? Evidence from South Asian Economies

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Abstract. This study aims to explain the effect of financial liberalization on environmental degradation (CO_2) emissions and ecological footprints in the South Asian Economies using data over the period from 1980 to 2017. The fully modified ordinary least square (FMOLS) and dynamic ordinary least square (DOLS) techniques have been used to examine the effect of financial liberalization on environmental degradation (measured by CO_2 emissions and ecological footprints). Findings show that financial liberalization does not significantly affect carbon dioxide emission, however, the positive and significant effect on ecological footprints is evident. Financial liberalization is a driving factor for economic growth but it is not better for environmental sustainability. This paper has a significant contribution to the regional ecology and also has important policy implications for promoting a sustainable environment in the South Asian Economies.

Keywords: Financial liberalization, CO_2 emission, Ecological footprints, South Asian economies

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1. Introduction

After the Second World War, there was a lot of pressure put on national resources, and the idea of free trade, economic growth, and urbanization was developed (Munir & Ameer, 2018). Meanwhile, over the last few decades, globalization has opened the door to international trade. This intensively less restricted trade between countries and concentration on the manufacturing sector has influenced environmental quality (Hultberg, 2018). Furthermore, emerging economies have expanded trade and investment activities under the free trade agreement. However, most of these countries rely on fossil energy causing environmental degradation (Akbar, Alam Rehman, Zeeshan, & Afridi, 2020). Hence, the volume of trade has been increasing globally but especially in Asia lower costs and cheaper natural resources are more attractive to investors (Ling, Ab-Rahim, & Mohd-Kamal, 2020). Although developed countries have already reformed their trade liberalization policies by incorporating environmental regulations in production, developing countries with open economies are still facing environmental degradation (Ling et al., 2020).

Trade liberalization is the removal or reduction of restrictions or barriers on the free exchange of goods between nations. This includes the

removal or reduction of tariff obstacles, such as duties and surcharges, and, nontariff obstacles, such as licensing rules, quotas, and other requirements (Mahrinasari, Haseeb, & Ammar, 2019; Tancho, Jermsittiparsert, & Chienwattanasook, 2021). Thus, the pollution-promoting effect of financial liberalization needs to be reduced in developing countries.

Ecological footprints were first introduced in the 1990s as the use of land and water for production consumed by humans and waste elimination generated by the population (Hassan, Xia, Khan, & Shah, 2019). On the other hand, since the 1990s, trade liberalization gained considerable attention from the world to promote economic growth but it escalated the volume of CO_2 emissions (Akbar et al., 2020) and also influenced ecological footprints (Al-Mulali & Ozturk, 2015). Energy Information Administration (EIA) predicted that carbon emissions of developing countries would increase by 127% shortly as compared to the developed countries.

Economic development largely depends upon natural resources (Hultberg, 2018). The key indicator of any country is the economic growth and a high standard of living (Shahbaz, Shahzad, Ahmad, & Alam, 2016) but it should not come from a deteriorating environment (Tamazian & Rao, 2010). South Asian economies have cheap labor with an abundance of natural resources. These economies have utilized their natural resources for economic growth but at the expense of environmental quality. They also have very less restricted trade without the enforcement of strict environmental regulations (Ling et al., 2020).

Shreds of evidence are available that there is a positive relationship between economic growth and environmental degradation in developing countries (Scott, McFarland, & Seth, 2013). Simply, an increase in trade will also increase the consumption of fuel and transportation to generate energy. However, in advanced countries, environmental quality is better than in Asian regions (Ahmed, Kousar, Pervaiz, & Shabbir, 2021) due to better regulations system (Hussain & Dogan, 2021).

However, previous studies could be divided into two aspects with financial liberalization and environmental degradation. Some researchers argued that financial liberalization boosts carbon emissions, while others argued that financial liberalization increased investment in energy-efficient technology that improved environmental quality and mitigated the consumption of energy (Tancho et al., 2021). However, several protection environment policies have already been developed by almost all countries but environmental degradation is increasing. Countries must impose environmental regulations Azam, Liu, and Ahmad (2021), where liberalization in trade is increasing economic growth, and this growth leads to environmental degradation (Le, Chang, & Park, 2016).

According to the best of our knowledge, previously financial liberalization was not studied specifically with environmental degradation (carbon emission, and ecological

footprints) for South Asian economies. Therefore, this study investigates the effect of financial liberalization on environmental degradation in the region of South Asian economies to reduce environmental pressure.

This study has a significant contribution to the existing literature by testing the effect of financial liberalization on environmental degradation with long-run estimations. It also helps economists, environmentalists, and policymakers in designing policies, especially for the Asian region.

2. Literature Review

2.1Financial liberalization and carbon emissions

Many researchers have examined the contributions of financial liberalization to carbon emissions. For example, Ling et al. (2020) investigated the effect of trade openness on environmental degradation in ASEAN-5 countries during the period from 1995 to 2014 by using the Panel unit root test, Pedroni Co-integration test, Panel Granger Causality test and found that trade openness and carbon dioxide emissions have a positive relationship among the countries under study. Similarly, Akbar et al. (2020) investigated the effect of trade liberalization on carbon dioxide emission in Southeast Asian countries for the period from 1991 to 2018 and used structural equation modeling (SEM). The empirical results reveal a nexus between trade openness, energy consumption, CO_2 emissions, and health expenditure in Southeast Asian countries. Both these researchers concluded that there was a positive and significant impact of trade on environmental degradation. Likewise, Tancho et al. (2021) investigated financial liberalization on environmental quality in ASEAN countries for the period from 2001 to 2018 and used the GMM estimator, and found that financial liberalization has a negative link with the environmental quality of ASEAN countries.

In contrast, Khan, Weili, Khan, and Khamphengxay (2021) have investigated trade openness and environmental degradation in developing and developed countries by employing static, dynamic, and long-run estimators. Trade openness has been found to have a decreasing effect on carbon emissions in developed countries while degrading the quality of the environment in developing countries. Here, regulations play an important role in environmental degradation. Similarly, Shahbaz, Tiwari, and Nasir (2013) also investigate the effect of trade openness on CO_2 emissions in South Africa using the error correction method (ECM) over the period 1965-2008 and found that financial liberalization reduces environmental degradation. Results further suggested increasing spending on energy conservation R&D results in energy efficiency and lower emissions.

Some researchers investigated these factors in the short-run and long run. For example, Oktavilia and Firmansyah (2016) have investigated the relationship between environmental degradation and trade openness in Indonesia by employing the error correlation model (ECM) for the period from 1976 to 2014.

They found that CO_2 emission partially influenced trade liberalization in the short run. Similarly, Le et al. (2016) investigated the relationship between trade openness and environmental quality using a panel data set over a period from 1990 to 2013 in 98 countries. They found that in the long run, trade openness causes environmental degradation in countries with middle and lower-income levels. Hua and Boateng (2015) investigated the long-run relationship between financial openness and carbon dioxide emissions across 167 countries over a period from 1970 to 2007 using the Dynamic GMM technique and found that financial openness reduces CO_2 emissions for all countries. They further found that countries of the North get more benefit from trade than countries located in the South side of the world.

Jamel and Maktouf (2017) investigated the nexus between economic growth, financial development, trade openness, and CO_2 emissions in 40 European countries by using panel data from 1985 to 2014 and utilizing the Cobb-Douglas production function to examine the causal link. They found a positive connection between CO_2 and trade liberalization. Hultberg (2018) investigated the effect of trade openness on environmental degradation by using a panel data set of Asian economies from 1986 to 2013 and found that trade openness and economic growth intensify CO_2 emissions.

Despite huge environmental pressure on South Asian Economies, many scholars did not pay much attention to this issue for the region. Previously, trade openness was studied with carbon emissions in South Africa (Shahbaz et al., 2013), on the environment of Asian economies (Akbar et al., 2020; Munir & Ameer, 2018; Hultberg, 2018), European countries (Jamel & Maktouf, 2017), with environmental degradation Asian countries, ASEAN-5 Countries (Ling et al., 2020), and MENA region (Al-Mulali & Ozturk, 2015).

Some evidence is developed related to the relationship between financial/trade liberalization and environmental issues in South Asian economies (Abbasi & Riaz, 2016; Adams & Klobodu, 2018; Boutabba, 2014; Hassan et al., 2019; Tancho et al., 2021). However, to the best of our knowledge, no prior study has tested the relationship between financial liberalization on environmental degradation using two different proxies, i.e., CO_2 emission and ecological footprints in South Asian economies. Furthermore, previous studies have not utilized DOLS and FMOLS to explore the underlying relationships.

2.2Financial Liberalization and ecological footprints

Many researchers have examined the contributions of financial liberalization to ecological footprints. Al-Mulali and Ozturk (2015) investigated the trade openness on environmental degradation (ecological footprints) in 14 MENA countries over a period from 1996 to 2012. They utilized Pedroni co-integration and the FMOLS technique and found that trade openness increases environmental damage. Moreover, the Granger causality test

found that variables under use have short-run and long-run causal relationships with the ecological footprint.

In contrast to these studies and to the best of our knowledge, no prior study has tested the relationship of financial liberalization on environmental degradation ecological footprints in South Asian economies.

3. Methods

3.1Data and sample

This study empirically explores the effect of financial liberalization on environmental degradation carbon dioxide emission and ecological footprints in South Asian economies such as Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka. Whereas, Afghanistan and Maldives are excluded from the study due to non-availability of the sufficient data. In this study, the data on carbon dioxide emission (metric ton per capita) and financial liberalization (trade % of GDP) are collected from the World Bank over the period from 1980 to 2017 whereas the data on ecological footprints (gha per person) from Global Footprint Network of the same period. The description and measurement of the variables are shown in Table-A.

3.2Economic Techniques

3.2.1 Cross-sectional dependence

For a better understanding of the results, it is necessary to check the cross-section dependence among variables (Baltagi & Hashem Pesaran, 2007). Breusch and Pagan (1980) and Pesaran (2004) tests are used for cross-sectional dependence see Table 2.

3.2.2Panel Unit root

To determine the stationarity of the panel data, a panel unit root test is used. Table 1. Descriptive Statistics unit root tests are utilized to check the stationarity assumption. This study uses Breusch and Pagan (1980) and Pesaran (2004) tests and finds cross-sectional dependence among the variables. Therefore, in this study, cross-sectional Im-Pesaran-Shin (CIPS) tests are used to check the stationarity of the data.

Table 1. Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
CO_2 emissions	228	0.502	0.384	0.028	1.783
E-Footprints	228	1.428	1.365	0.443	5.071
FL	228	47.859	24.536	12.219	116.549

3.2.3. Cointegration tests

Cointegration tests are used to examine the long-run relationship among the variables. In this research, Pedroni (1999), Kao (1999), and Westerlund and Edgerton (2007) tests are used for cointegration to examine the long-run relationship among the variables.

3.2.4. Estimation techniques

In this study, fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) models are used. These approaches are useful, even in the presence of heterogeneity and endogeneity. Kao and Chiang (2001) illustrated that FMOLS can deal with these problems because the FMOLS estimator is developed after making the corrections for serial correlation and the issue of endogeneity in the estimator of ordinary least squares (OLS).

Table 2. Cross-sectional dependence

Variable	Pesaran CD 2004	Decision
CO_2 emission	21.770***	Cross-sectional dependence exists
E-footprint	10.100***	Cross-sectional dependence exists
F-Liberalization	3.270***	Cross-sectional dependence exists

Table 3. Cross-Sectional Im Pesara and Shin (CIPS) Unit Root

Variables	Level		First-Difference		Order of Integration
	Constant	Constant and trend	Constant	Constant and trend	
E-Fprints	4.3711	-0.869	-8.700***	-9.049***	I(1)
CO_2	10.238	3.085	-7.307***	-8.448***	I(1)
FL	0.211	-0.928	-8.203***	-8.230***	I(1)

4. Results

4.1 *Descriptive Statistics*

Table 1 mentioned below descriptive statistics shows the results for all the variables used in the study. Our results reveal that the mean of financial liberalization (FL) is 47.859 ranging from 116.549 to 12.219.

The mean value of Ecological footprints is 1.428, with a maximum and minimum of 5.071 and 0.443, respectively. The mean of carbon dioxide emissions is 0.502, with a maximum and minimum of 0.028 to 1.783, respectively.

4.2. Cross-sectional dependence

The results of the Table 2 are showing that the test of Pesaran CD 2004 which is applied to test the cross-sectional dependency of all the variables and found significant results, as the null hypothesis of cross-sectional independence for all the variables is rejected at the 1 percent level of significance.

4.3. Unit-root test

Below Table 3 describes the results of the stationarity test for all variables by using CIPS unit-root test at the level and first difference for the constant effect and trend. The test has a null hypothesis of nonstationary series. The results of all these variables are nonstationary at the level. Hence, the null hypothesis of the nonstationary series is rejected, because the variables become stationary at the first difference are significant and integrated of order 1.

4.4. Cointegration

Cointegration results are shown in Table 4. The study uses different cointegration tests like Pedroni (1999), Kao (1999), and Westerlund and Edgerton (2007). Further, these tests are conducted separately with carbon dioxide emission and ecological footprints. The results of Pedroni (1999) indicate that the null

hypothesis of the test is rejected. Philips Perron (PP) and Augmented Dicky Fuller (ADF) are significant for CO_2 emission. Similarly, the statistics of another dependent variable which is ecological footprints are also significant at 1%. From these results, it is concluded that long-run relationships exist among the variables. Meanwhile, the results of the Kao (1999) cointegration test also indicate the presence of a long-run association among the variables. However, the results of the Persyn and Westerlund test reveal that a long-run relationship among variables does not exist. Based on the results of all these cointegration tests, it is concluded that a long-run relationship exists between CO_2Emission, Ecological Footprints, and Financial Liberalization.

*4.5. **Results of FMOLS and DOLS***

Fully modified ordinary least squares (FMOLS) and Dynamic ordinary least squares (DOLS) were used to estimate the long-run coefficients as shown in Tables 5 and 6. These tests are separately used for both dependent variables (CO_2 emission and Ecological Footprints). The results of FMOLS concerning the first dependent variable (CO_2 emission) explain that the coefficient (0.003) of financial liberalization (FL) is positive but insignificant. Similarly, the results of Dynamic ordinary least squares (DOLS) are also positive but insignificant. These results show that the increase or decrease in financial liberalization of any country in South Asia does not affect carbon dioxide emissions. The results of financial liberalization with CO_2 emission of this study are different from the opinion of Tancho et al. (2021)who divide the different researchers into two categories, some researchers are with financial liberalization due to its positive role in environmental degradation (CO_2 emission), others researchers found its negative impact.

However, the results of financial liberalization with ecological footprints are positive and significant. In this study, FMOLS and DOLS approaches are also used to test the impact of financial liberalization on ecological footprints. The results of FMOLS show that an increase of 1% in financial liberalization of any country in South Asia will increase by 4% of ecologically footprints.

Table 4. Panel Co-integration: ***Pedroni (1999) Cointegration***

	DV=CO2		DV= E-Footprints		
	PP	ADF	PP	ADF	Decision
Statistics	6.696***	6.888***	3.574***	3.451***	Cointegration exists
p-value	0.000	0.000	0.000	0.000	

Kao (1999) Cointegration

	DV=CO2	DV=E-Footprints	
	ADF	ADF	Decision
Statistics	5.4790***	-1.367***	Cointegration exists
p-value	0.0000	0.0857	

Westerlund (2007) Cointegration

	DV=CO2				DV=E-Footprints				Decision
	Gt	Ga	Pt	Pa	Gt	Ga	Pt	Pa	
Statistics	-0.140	-0.709	1.315	1.486	-0.802	-3.867	-3.017	-3.879	Cointegration not exists
p-value	1.000	0.998	1.000	0.999	0.996	0.930	0.703	0.577	

Table 5. FMOLS and DOLS (DV=Carbon Dioxide Emission)

Variable	FMOLS DV:CO2 Coefficient	p-value	DOLS DV: CO2 Coefficient	p-value	Decision
FL	0.003	0.194	0.001	0.452	Rejected
R2	0.027		0.059		

Table6. FMOLS and DOLS (DV=Ecological Footprints)

Variable	FMOLS DV: CO_2 Coefficient	p-value	DOLS DV: CO_2 Coefficient	p-value	Decision
FL	0.045	0.000	0.041	0.000	
R2	0.512		8.951		Accepted
Adjusted R2	0.509		-29.541		

5. Discussions& Conclusions

Among the three pillars of sustainability, environmental sustainability is very important and essential for achieving sustainable development (Díaz de Otálora, del Prado, Dragoni, Estellés, & Amon, 2021). The present study examines the effect of financial liberalization on environmental degradation (CO_2 emission and ecological footprints). As the environmental quality in the South Asian region is worse than that of other regions of the world (Ahmed et al., 2021) due to better regulations system (Hussain & Dogan, 2021). This study is based on South Asian countries from 1980 to 2017. Two countries (Afghanistan and Maldives) are excluded from the study due to the unavailability of data in different years. Furthermore, FMOLS and DOLS models are utilized to examine the empirical results. Based on the results of these approaches, there are some interesting findings.

First, the study found that financial liberalization does not affect carbon dioxide emissions. However, the countries under study are largely dependent upon natural resource exploitation to increase economic growth as these resources are cheap and low-cost in the region Ling et al. (2020), further a lot of free trade agreements (Akbar et al., 2020) are causing environmental degradation. Whereas, several researchers have positive and negative opinions (Tancho et al., 2021) about the financial liberalization factor (Murshed, Rahman, Alam, Ahmad, & Dagar, 2021). Second, the effect of financial liberalization on ecological footprints is positive and significant. Hence, it is concluded that financial liberalization is not good for environmental sustainability.

This study has a few implications. Firstly, the financial liberalization use of advanced technologies for natural resources exploitation minimizes environmental degradation. Secondly, improved institutional quality could be helpful in the implementation of transparency and regulations and in fighting against corruption. Policymakers should focus on an extensive trade in South Asian economies as free trade without regulations has been causing environmental damage. So, trade policies must be redesigned and formulated for the betterment of environmental quality. Otherwise, this extensive free trade and financial liberalization could influence achieving the objective of SDGs 2030.

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