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Remittances, Financial Development, and Environment Quality: Evidence from South Asia

Sumaira[1], Amir Sajjad[2], Hafiz Muhammad Abubakar Siddique[3]

Abstract
Remittances inflow and financial development not only the important determinant of economic growth but also the polluting factor of environment in South Asian countries. This study is carried out to find out the impact of remittances and financial development (FD) on the environment pollution for the panel data over 1984 to 2018 by using panel OLS, fixed effect (FE) model, FMOLS and Pedronic co-integration test. The findings of co-integration test confirm the presence of long run association between the variables. Remittances, FD, energy consumption and FDI lead to environmental degradation while trade is the improving factor of environmental quality. The governments of South Asian countries should discourse the conflicting effect of remittances on environmental quality through severe limitations on highly polluted industries by strict financial procedures.
Key Words: Financial Development, Remittances, CO2 emissions, Trade

1. Introduction

Environmental pollution and global warming have attracted a substantial attention across the world. The increasing trend in CO2 emissions harms the ecosystem and contributes to the global warming (Tsadiras et al. 2020; Ali et al., 2022). The bad air quality is the root cause of health-related issues in the developing countries (Liu et al. 2018; Yang et al. 2021). Remittances greatly increase the household incomes as well as reduce the poverty level. It enables the households to purchase luxury items and boosting their consumption expenditures (Ahmed et al., 2021). Remittances are not only a novel financial phenomenon but also considered a source of revenue (Meyer & Shera, 2017).

South Asian countries are the receivers of substantial amount of remittances. Remittances are the basic way to reduce the poverty level and financial resources for impoverished households to start a small private enterprise.

The remittances inflow to the developing countries has been deliberated as one of the expected wellsprings of finance for attaining the sustainable economic development (Elbatanony et al., 2021). The remittances inflow affect the credit ratings in low income countries. It influences macroeconomic variables as well as microeconomic variables, and has a favourable impact on balance of payment (Hijazi, 2016). Furthermore, remittances support financial growth by expanding the assets for credit, particularly to independent projects that regularly face the troubles to get capital from financial institutions (Basarir and Cakir, 2015).

Presently, it is found that remittances inflows are degrading factor of environment in different countries (Yang et al., 2021). Motelle (2011) indicated that remittances inflow is a vital to encourage financial growth. The increased inflow of remittances often lead to rise in demand for financial facilities either for savings or money transfer. Moreover, remittances help small organizations by giving funds and encourage the national investment. Also, extensions of firms through remittances contributes to environmental degradation. In the current era, remittances inflow is essential to stimulate economic activities but at the same time, environmental pollution increases as a result of industrialization (Meyer and Shera, 2017).

However, there are a number of reasons to contend that remittances are probably causing environmental pollution through different ways: Remittances may have a direct influence if they raise household standards of living, resulting in increased consumption (Thapa and Acharya, 2017). It might increase the buying power and make trouble-free access to domestic things (automobile, air conditioning, electric machines, and so on) and subsequently increasing energy use and pollution as well. When remittances-induced investment leads to an increase in energy demand, other direct effects may occur (Chami et al., 2005). However, it may ultimately influence the environmental quality through a few channels namely financial development, economic growth and industrialization (Elbatanony et al., 2021).

The researchers have contended that financial development (FD) is not only crucial to the growth of economy but also influence the quality of environmental particularly on the evolution of CO2 emissions (Tamazian et al., 2009). Hypothetically, FD may improve the environment by decreasing pollution through technical research. In spite of its relevance, FD that is generally associated with expanded energy utilization, economic development and innovative can bargain natural quality of environment and subsequently enhances to carbon emissions (Acheampong, 2020; Sadorsky, 2010). Ziaei (2015) argues that FD assumes an important part in growth of an economy and either it may have an increasing or decreasing effect on environment.

Financial development has two types of effects on the economies; wealth effect and scale effect Du et al. (2020). In terms of wealth, the extension of the FD encourages the clients for appropriate capital facilities at lower cost. As the families purchase more expensive items (vehicles, residences, and electronic devices) their living standard rises. Regarding the scale effect, the development including capital market leads to increase the scale of output

[1] Department of Business and Commerce, GIFT University, Gujranwala, Pakistan
[2] Govt. Jinnah Islamia College, Sialkot, Pakistan
[3] Department of Business and Commerce, GIFT University, Gujranwala, Pakistan

level. The output level needs further financial support to securing huge scales new equipment. It indicates the scale impact of financial improvement over CO2 (Tsaurai, 2019; Arshad and Ali, 2016; Ashraf and Ali, 2018).
Although, some foreign investors intensely contributes in clean energy related R&D projects and brings along their current circumstance well-disposed innovation that produces less quantity of carbon outflow. Financial advancement may build the variety and scale of producing activities in the country through providing more financial support to the domestic organizations. It may result from rising CO2 emissions as well as worsening land degradation (Aye & Edoja, 2017).
The factors that contribute to environmental degradation are extremely investigated in literature. Economic growth is the main source of GHGs, in addition to this indicator. Higher economic growth need extensive use of energy in manufacturing. This enhanced economic growth lead to environment pollution. In the South Asia, the effect of remittances on environmental quality has yet to be empirically studied. Therefore, this study fills the gap in prevailing work by using remittances inflows, FD and their effects on the quality of environment in South Asian countries.

2. Literature Review

The literature review in the perspective of remittances, FD and environmental quality relationship is described. This section is further consist of two sections, the first discusses the relationship between remittances and environment, and the second contains in the area of FD and environmental quality.

2.1 Remittances and Environmental

Yang et al. (2021) analysed the environmental effects of remittances by employing the DSUR and FMOLS approaches in the BICS countries over 1990 to 2016. The findings concluded that inflow of remittances and FD have the significant and harmful effects on the environment while technological innovations are helpful to improve the environmental quality.
Neog and Yadava (2020) in his study scrutinised the influence of remittances on environment in context of India by covering time span of 1980 to 2014. The conclusions revealed that the increasing shocks of remittances enhance the pollution in India. Similarly, Khan et al. (2020) carried out an empirical study with a goal to find the association between CO_2, remittances, income, energy use and FDI by using FM-LS and CCEMG (common correlated effect mean group), covering the duration of 1986 to 2016 in the BRICS countries. The long run relationship exists through panel co-integration tests. The empirics of FM-LS and CCEMG indicated that the inflow of remittances is the increasing factor of CO_2 emissions except in India. Rehman et al. (2019) also carried out remittances and pollution nexus in the six selected Asian countries by using the ARDL model. The study used the annual panel data during 1982 to 2014. The empirical results indicated that remittances are considered as the increasing factor of CO_2 in the long-term.
Zia et al. (2020) presented a link between remittances and environment. The CCEMG and FM least square were used for estimation of BRICS countries during 1986 to 2016. The consequences of CCEMG and FM-LS declared remittances inflow hurts the environment into BRICS countries except India. The results of Waterlund test supported the presence of long run association. The panel causality results show two way causality amid CO_2 emissions and remittances inflow.
Brown et al. (2020) test the EKC with a new version to check the nexus between remittances inflow and CO_2 by using ARDL and NARDL technique in Jamaica, covering the duration of 1976 to 2014. The results affirmed the presence of co-integration between the concerned variables, and CO_2 emissions has an increasing trend because of the positive shocks in remittances.
Ahmad et al. (2019) argued that remittances lead to substantial influence on the Chinese economy but affect the environmental quality. The study used the NARDL model for the years of 1980 to 2014. The remittances are further divided into two dimensions as increasing and decreasing shocks in remittances. The outcomes of NARDL also concluded that the impact of increasing shocks in inflow of remittances are greater than the decreasing shocks on CO_2 emissions.
Alshubiri and Elheddad (2019) investigated CO_2 emissions and remittances inflow by employing the FE and GMM approach for the years 1990 to 2015 in 32 OECD economies. The outcomes of the study showed, at the initial stage, remittances has increasing trend towards CO_2 emissions, while, after the peak point, the concerned variables reduce CO_2 emissions.
Remittances inflow has a substantial effect on the economy's output growth but it has a linked to CO_2 emissions. Ahmad and Majeed (2021) inspected the nexus between remittances and CO_2 in Pakistan during 1980-2018. The results of NARDL and ARDL highlighted that positive remittances shock lead to increase the pollution while a negative remittances shock reduces pollution. Jafri et al. (2021) employed the NARDL model to look at the asymmetric influence of remittances on CO_2 emissions in Chinese economy during the time span of 1981 to 2019. The results ensure that a decrease in remittances has both short and long-term favourable effects on pollution.

2.2 Financial Development (FD) and Environment

Ahmad et al. (2018) inspected the FD on CO_2 emissions nexus by employing NARDL and ARDL models. The annual data set was selected from the period of 1980 to 2014 in the case of China. The long-term association

between the series was confirmed by ARDL bounds test. The findings of ARDL and NARDL indicated that FD is the polluting factors of environment in the long term.

Baloch et al. (2019) studied that and environmental impact of financial development for fifty-nine (BRI) countries during 1990 to 2016, using Driscoll-Kraay (DK) analysis because of its advantages for handling the missing data as well as the large sample dataset. The outcome of this analysis verified that FD significantly deteriorate the environment. Nasir et al. (2021) concluded that FD increase the environmental pollution in Australia during 1980 to 2014. The findings confirmed the bidirectional causality between FD and environmental pollution.

Dar and Asif (2018) confirmed the long run connection between FD and CO_2 emissions during 1960 to 2013 in Turkey. The empirical findings revealed the inverse relationship between FD and CO_2 emissions. Lahiani (2020) presented an asymmetric influence of FD on CO_2 emissions by using the non-linear ARDL model in case of China during the time of 1977 to 2013. The attained findings showed that increasing or decreasing effects in FD improve the environment.

Tsaurai (2019) checked the nexus between FD and CO_2 emissions in 12 West African countries by covering the years from 2003 to 2014. The empirics indicated that FD significantly enhances CO_2 emissions. Al-Mulali et al. (2015) conducted an empirical study to check the consequences of FD on CO_2 emissions by DOLS approach. The study covered the panel data of 129 countries according to their income level from 1980 to 2011. Main findings confirmed that FD is considered as the improving factor of environmental quality.

The empirical study of Lahiani (2020) showed that FD employs irregular long-term impact on CO_2 emissions in China during the time span of 1977 to 2013. Zhao and Yang (2019) found the impact of FD on carbon dioxide emissions in China's provinces during the era of 2001 to 2015. Two-way causative association in long run exists for FD and CO_2 emissions but it does not prevail in short-run. This study also revealed that financial development was the crucial vigor for lessening pollution at provincial level.

Jiang and Ma (2019) inspected the link between FD and CO2 emissions during the time span of 1960 to 2014 by GMM for 155 nations (including 35 developed nations and 120 developing nations). The observational outcomes demonstrated that from a worldwide point of view, FD significantly enhances CO_2 emissions, and the investigation of the developing nations arrives at a similar decision; however FD does not become the polluting factor of environment in case of the developed nations.

Shahbaz et al. (2013) scrutinized the environmental impact of financial development during the period of 1971 to 2008 evidence from Malaysia. The outcomes of the ARDL model established the presence of co-integration between pollution and FD. The empirical evidence showed that FD improves the environment by reducing CO_2 emissions.

Saud et al. (2019) explored the influence of financial level on environment for 18 CEUC, using the panel data of 1980 to 2016. The empirics of DSUR provided the evidence that FD puts the harmful impacts on environment. The hypothesis of EKC was held for the certain panel countries. Moreover, the causation findings established the presence of connection for FD and environment. The outcomes of Majeed et al. (2020) disclosed that FD significantly enhances CO_2 emissions but decreasing shocks in FD has a strong consequence on CO_2 than the increasing shocks in FD in Pakistan over 1972 to 2018. The findings also demonstrated the validity of the asymmetric relation between FD and the quality of environment. Isik et al. (2017) explored a vibrant impact of FD on CO_2 emissions for Greece.

3. Theoretical and Econometric Model

The factors of environmental degradation are tremendously investigated in energy economics. Remittances inflows raise household income and stimulate demand for commodities, boosting the manufacturing process (De and Ratha 2012; Meyer & Shera 2017). Increased demand for energy is a result of increased production activity (Irons and Irons 2019). The massive demand for energy lead to negative impact on the environment (Yang et al. 2020a). Various studies emphasize that remittances inflow is the polluting factor of environment. Following the empirical studies of Ahmad et al. (2019), Neog and Yadava (2020), Yang et al. (2020), Jafri et al. 2021, this study establishes the consequence of remittances and financial development (FD) on the quality of environment. Remittances, FDI, energy consumption, and trade were regarded by Rehman et al. (2019) and Elbatanony et al. (2021) to be the determinants of CO_2 emission. However, most of the researcher used CO_2 emissions as proxy of environmental quality. Thus, the relationship is stated in the following functional form as

$$CO_2 = f(\text{REM, EG, EC, FDI, TR}) \quad (1)$$

The study of Baloch et al. (2019), Nasir et al. (2021) and Yang et al. (2021) found that FD is also harmful for the environment and the functional form is as

$$CO_2 = f(\text{FD, EG, EC, FDI, TR}) \quad (2)$$

By using the equation (1) and (2), the two econometrical models are as

$$lnCO_{2it} = \alpha_o + \alpha_1 lnREM_{it} + \alpha_2 lnEG_{it} + \alpha_3 lnEC_{it} + \alpha_4 lnFDI_{it} + \alpha_5 lnTR_{it} + \mu_{it} \quad (3)$$

$$lnCO_{2it} = \beta_o + ln\beta_1 FD_{it} + \beta_2 lnEG_{it} + \beta_3 lnEC_{it} + \beta_4 lnFDI_{it} + \beta_5 lnTR_{it} + \varepsilon_{it} \quad (4)$$

In equation 3 and 4 CO_2 illustrates environmental quality, REM is the personal remittances, FD used for financial development. Furthermore, EG indicates economic growth, EC is energy consumption while FDI and TR indicate foreign direct investment and trade openness respectively. All these above variables are transformed into the

natural logarithmic form. The terms μ and Ɛ are error terms, i is used for the five South Asian countries and t is for the period from 1984 to 2018. The terms α_0 and β_o are the intercepts while α_1, α_2,...,α_5 and β_1, β_2,….., β_5 are the elasticities of explanatory variables.

4. Methodology

The study uses two models to find out the environmental effects of remittances inflow and financial development in the selected countries of South Asia. To find the integration order for each of the concerning variable is essential because all variables must be stationary at their first difference in order to do a cointegration analysis. The ADF and Levin Lin and Chu unit root tests are employed. Pedroni (1999) cointegration test allows the cross-areas to be commonly reliant on one another while having different aspects. In the Pedroni cointegration test, various statistics and p-values are used to determine whether the null hypothesis is rejected or accepted.

The Panel OLS method is used to determine the relationship between the variables. This is employed by using panel data without considering the individual's impact. Fixed Effects (FE) model is used on the behalf of Hausman test. The FE model is used to obtain more consistent and reliable findings. It also eliminates the effect of time invariant properties, allowing the coefficients of this model to be estimated without bias. The robustness of both models is also tested using FMOLS.

5. Data

The study aims to find out the impact of remittances inflow and FD on environment, taking annual data of 1984 to 2018 for South Asian countries. The South Asian countries that have been taken include Bangladesh, India, Nepal, Pakistan, and Sri Lanka. The WDI (2022) has been used to derive the data of relevant variables. CO_2 emissions are used as proxy of environment that is measured in metric tons per capita, remittances inflow is presented in current US Dollar while FD is estimated as domestic loans to private sector (percent of GDP). Economic Growth as GDP per capita constant 2015 US $ and energy consumption is in the form of kg of oil equivalent per capita whereas net inflow of FDI and trade (% of GDP) are used to control the variation of the model.

5.1 Descriptive Analysis

Table 1 depicts the findings of descriptive statistics which reveal that the average of CO_2 emissions is 0.5278, its maximum score is 1.7998 while the minimum score is 0.0402. Financial development has the mean value of 29.1819, the maximum and minimum values are 76.3246 and 8.4859, respectively. Table 1 also describes the statistics of the rest series.

Table 1: Results of Descriptive Analysis

Variables	Obs.	Mean	Min.	Max.	St. Dev
CO_2	175	0.5278	0.0402	1.7998	0.3911
REM	166	9130000000	44160126	78800000000	16000000000
FD	175	29.1819	8.4859	76.3246	13.1255
EG	175	1123.70	378.296	4157.284	762.3661
EC	155	350.76	106.4292	636.5718	121.1014
FDI	175	0.7633	-0.0984	3.6683	0.7333
TR	175	41.0007	12.2193	88.6364	17.1596

5.2 Correlation among Variables

Table 2 indicates the positive correlation between remittances inflow, FD, economic growth, energy consumption FDI and CO_2 emissions under the model 1. The negative sign with trade openness indicates the inverse relation of trade with pollution.

Table 2: Results of correlation Matrix (Model 1)

variables	CO_2	REM	EG	EC	FDI	TR
CO_2	1					
REM	0.7424	1				
EG	0.3636	0.1053	1			
EC	0.7880	0.4731	0.5213	1		
FDI	0.5841	0.4551	0.4988	0.5240	1	
TR	-0.0165	0.0514	0.5620	0.3173	0.3744	1

Table 3 expresses the outcomes of correlation for model 2, accordingly remittances, financial development and rest variables are positively linked with CO_2 emissions.

Table 3: Results of correlation Matrix (Model 2)

variables	CO_2	FD	EG	EC	FDI	TR
CO_2	1					
FD	0.4510	1				
EG	0.4181	0.2649	1			
EC	0.7757	0.4299	0.5265	1		
FDI	0.6111	0.4080	0.5254	0.5293	1	
TR	0.0162	0.2563	0.5676	0.3236	0.3856	1

6. Results and Discussion

This section comprises the empirics based on OLS, FE and FMOLS model and Pedroni Co-integration. Table 4 describes the findings of unit root tests. Table 5 and 6 report the outcomes OLS, fixed effect and FMOLS estimates of model 1 and model 2 respectively. Table 7 and 8 present the findings of co-integration tests of both models.

The findings of ADF and Levin, Lin & Chu unit root tests are stated in Table 4. The results indicate that the concerned variables have first order of integration. CO_2, remittances, FD, EG, energy, FDI and trade are integrated at their first difference.

Table 4: Results of Panel Unit Root Tests

Variables	ADF- Fisher Chi-square				Levin, Lin & Chu			
	Level		1st difference		Level		1st difference	
	T-value	Prob.	T-value	p-value	T-value	Prob.	T-value	p-value
CO_2	0.6293	1.0000	45.1222	0.0000	1.4863	0.9314	-3.6941	0.0001
REM	1.8379	0.9998	32.5315	0.0003	-0.8407	0.2003	-1.4588	0.0723
FD	4.5941	0.9166	43.1005	0.0000	0.0178	0.5071	-3.7750	0.0001
EG	0.0842	1.0000	55.2112	0.0000	6.1696	1.0000	-2.4599	0.0069
EC	6.8654	0.7381	40.5097	0.0000	2.8333	0.9977	-1.6606	0.0484
FDI	12.1653	0.2741	80.0040	0.0000	-0.1871	0.4258	-6.0543	0.0000
TR	6.9423	0.7309	38.5188	0.0000	-0.7951	0.2133	-1.5799	0.0571

In Table 5, the results of OLS for model 1 indicate that all the variables significantly affect CO_2 because the probability values of all the variables are less than 1% level of significance (Table 5). The outcomes specify that remittances inflow is the polluting factor of environment because it increases the pollution 0.13% (Ahmed et al., 2021; Jafri et al., 2021). Trade openness is the improving element of environment. The coefficient of trade indicates 1% rise in trade causes a 0.841% reduction in the CO_2 emissions. The coefficient of economic growth (EG), energy consumption (EC) and FDI specify that a 1% rise in EG, EC and FDI enhance the environmental pollution by 0.5143%, 0.8789 and 0.1224% respectively, these empirics are also related to literature (Siddique et al., 2016).

According to the empirical findings of fixed effects model, all the explanatory variables except trade have the harmful effects on the environment. Remittances (REM) and economic growth (EG) have the coefficient of 0.0621 and 0.2919 that indicate a 1% increase in REM and EG cause 0.0621% and 0.2919% of pollution. The coefficients are significant and similar to the results of the prior study (Yang et al., 2021; Rehman et al., 2019; Qingquan, 2020). Trade is negatively related to CO_2, it means trade improve the environmental quality and it also confirms the technological effect (Antweiler et al., 2001; Shahbaz et al., 2017). The findings exposed that EC and FDI are the increasing factor of CO_2, it means that 1% rise in EC and FDI lead to 1.8411% and 0.0211% harmful effects on environment (Rehman et al., 2019; Khan et al., 2020).

The empirics of FMOLS are also reported in table 5, which indicate that remittances economic growth and energy are polluting environment. FDI has the positive and insignificant impact while trade has the favourable impact on the environment.

Table 6 reports the findings of OLS, fixed effects and fully modified OLS for model 2 of South Asia. According to the empirics of OLS model, FD, economic growth (EG), energy consumption (EC) and FDI significantly increase the pollution at 1% level of significance but trade (TR) has negative effects on environmental degradation. The coefficients of FD depicts a 1% increase in FD increases the environmental degradation by 0.4330%, and a 1% increase in EG, EC and FDI increase 0.9421%, 0.6727% and 0.2046% level of pollution correspondingly and these outcomes are consistent with the prior research (Szymczyk et al., 2021). A 1% increase in trade enhances the quality of environment by 1.377%.

The results of fixed effects model revealed that all the variables have the direct relation with CO_2 emissions except trade. The coefficients indicate that a 1% rise in FD and EG lead to 0.4284% and 0.2835% increase in environmental degradation respectively, and these findings are similar with the literature (Lu, 2018; Cetin et al., 2018). The coefficients of EC and FDI also indicate 0.4145% and 0.0225% increase in carbon dioxide emissions, these consequences are also consistent to literature (Jafri et al., 2021). Trade openness does not harm the environment (Khan et al., 2022).
The results of FMOLS show that FD pollutes the environment. EG, EC and FDI increase CO_2 emissions while trade improves the environmental quality of South Asia.

Table 5: Empirics for Model 1

	Dependent Variable: Environmental Pollution					
	OLS		FE		FMOLS	
Variables	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
REM	0.1370***	0.0040	0.0621***	0.0023	0.0571*	0.0814
EG	0.5143***	0.0008	0.2919**	0.0227	0.0544**	0.0463
EC	0.8789***	0.0002	1.8411***	0.0009	1.7441***	0.0007
FDI	0.1224***	0.0008	0.0211*	0.0820	0.0215	0.3048
TR	-0.841***	0.0005	-0.246***	0.0092	-0.223***	0.0003
C	-0.93310	0.0004	-13.9963	0.0065	-	-
Obs.	137		137		131	
R^2	0.87		0.88		0.88	

Note: *, **, and *** indicate 1%, 5% and 10% significance level.

Table 6: Empirics of Model 2

	Dependent Variable: Environmental Pollution					
	OLS		FE		FMOLS	
Variables	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
FD	0.433***	0.0002	0.4284***	0.0005	0.3046***	0.0008
EG	0.9421***	0.0001	0.2835**	0.0443	0.5792***	0.0055
EC	0.6727***	0.0007	0.4145**	0.0303	0.5342***	0.0006
FDI	0.2046***	0.0000	0.0225*	0.0806	0.0752*	0.0831
TR	-1.377***	0.0000	-0.195***	0.0005	-0.274***	0.0064
C	-7.5332	0.0004	-5.9862	0.0009	-	-
Obs.	145		145		138	
R2	0.83		0.85		0.84	

Note: *, **, and *** indicate 1%, 5% and 10% significance level.

Pedroni co-integration test scrutinizes the long run relationship for model 1 and 2 in South Asia. Table 7 and 8 are reporting the findings of Pedroni test for both models. The findings concludes that the remittances, financial development, energy, FDI and trade are cointegrated in the long run in light of the fact that four values of statistics out of the seven values of statistics strongly reject the null hypothesis of no cointegration in South Asia.

7. Conclusion and Policies

Remittances inflow and financial development not only the important determinant of development process in developing countries but also the polluting factor of environment. The study finds the impact of remittances inflow and FD on the environment of South Asian countries by keeping the role of economic growth (EG), energy consumption (EC), FDI and trade during 1984 to 2018. The study used OLS, fixed effects model and Pedronic co-integration test. The environmental quality is the dependent variable and the proxy for measuring the environment is CO_2 emissions. The data of the above variables was extracted from the WDI. Remittances inflow, FD and the rest factors are co-integrated in the long-run. The main findings of panel OLS indicate that remittances, FD, economic growth, energy consumption and FDI enhance the environmental pollution while trade has the favourable impact on the environment. These findings concur with those of the fixed effects and FMOLS analyses. In the view of above-mentioned findings, the study proposes some policy implications to the South Asian economies for reducing the environmental degradation. The governments of South Asia should discourse the conflicting effect of remittances on environmental quality through severe limitations on highly polluted industries by strict financial procedures. However, these economies should apply the credit policies that confirm the credits avail by the financial sectors to the internal companies towards attaining the environmental friendly technology and equipment that reduce CO_2 emissions. Thus, the increase in proficiency in energy on petroleum use will be helpful to reduce environmental degradation without disturbing the production level.

Table 7: the results of Pedroni Co-integration (Model 1)

Alternative hypothesis: common AR coefs. (within-dimension)				
	Statistics	Prob.	Statistics	Prob.
P. v-Stat	-0.8426	0.8003	-0.3448	0.6349
P. rho-Stat	0.9095	0.8185	0.5042	0.6930
P. PP-Stat	-1.4267*	0.0768	-1.8766**	0.0303
P. ADF-Stat	-1.5885*	0.0561	-1.2821*	0.0999
Alternative hypothesis: individual AR coefs. (between-dimensions)				
	Statistics		Prob.	
G. rho-Stat	1.1821		0.8814	
G. PP-Stat	-2.5597***		0.0052	
G. ADF-Stat	-3.2928***		0.0005	

Note: *, **, and *** indicate 1%, 5% and 10% significance level.

Table 8: Results of Pedronic Cointegration (Model 2)

Alternative hypothesis: common AR coefs. (within-dimension)				
	Statistics	Prob.	Statistics	Prob.
P. v-Stat	0.6974	0.2428	0.3851	0.3501
P. rho-Stat	0.3402	0.6331	0.1503	0.5597
P. PP-Stat	-1.2642*	0.0958	-1.5246*	0.0637
P. ADF-Stat	-1.6205*	0.0526	-2.5202***	0.0059
Alternative hypothesis: individual AR coefs. (between-dimensions)				
	Statistics	Prob.	Statistics	Prob.
G. rho-Stat	1.0127		0.8444	
G. PP-Stat	-1.3287*		0.0920	
G. ADF-Stat	-2.0926**		0.0182	

Note: *, **, and *** indicate 1%, 5% and 10% significance level.

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