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External determinants of environmental sustainability in Pakistan

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Abstract

This study examines the relationship between external factors and environmental sustainability in Pakistan focusing on carbon emission as a dependent variable and FDI, Remittance, Population growth, and Imports as an independent variable. We explore the impact of external factors that affect environmental sustainability in the context of Pakistan. So we apply econometrics techniques such as unit root, Johnson cointegration, and vector error correction model test on the time series data over the period 1980 to 2022 from WDI. In this study, short-run results suggest that remittance can impact significantly on CO2 emissions in the short run. The long-run result suggests population can intensify carbon emissions in Pakistan. So the policymakers in Pakistan encourage to establish a system that promotes environmental sustainability clean environment and inhibits the emission of carbon in Pakistan.

Key words: environmental sustainability, remittances, Imports, FDI.

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INTRODUCTION

Pakistan, like many developed nations, is facing hurdles to maintain a balance between economic growth and environmental sustainability. When the country starts economic development it faces various external factors that have a significant impact on environmental sustainability. The main purpose of this introduction is to highlight how variables e.g. FDI, Remittance, Population, Imports, and CO2 emissions interact with Pakistan's environmental sustainability. Pakistan's industrialization and energy consumption have significantly increased carbon emissions. Depending upon the fossil fuels and coupled with limited regulation on emissions can lead to environmental degradation. In recent Pakistan become the biggest carbon emitter in the world so as a result they have faced very serious results of climate change in the last ten years. So maintaining the balance between economic growth and carbon footprint would become a major challenge for the policy makers.

Foreign direct investment play a very significant role in the development of the country. In Pakistan they play a very vital role for the shaping the economic outlook. FDI inflow introduced the new expertise and technology and capital. So the industries wants to maximize profit through FDI so as a result they can lead to increase pollution and resource depletion, habitat destruction unless and until environmental sustainability become disturb. Remittance also play a very vital role in the economic development in Pakistan. Remittance can contribute heavily in the Pakistan economy. Remittance may change the consumption pattern it may leads to increases the demand for water energy and other resources. It create pressure on the natural resources and ecosystem. So in order to managethese inflows sustainability requires remarkable policies that maintain balance in the economy with environmental governance.

Imports can show significantly impact on the environmental sustainability especially in Pakistan. It can impact on environment through transportation cost it can lead to increase carbon emission through truck ships and planes and other automobiles. Additionally importing may produce in the countries with lower environmental standard it can cause environmental problem like resource destruction and other issues. Population growth can show a negative influence on the economic practices and environmentalsustainability. Rapid increase in population can put pressure in the economy and increases

the demand for necessities i.e. food, energy and shelter. Furthermore, a large numberof people can cause pollution and environmental degradation. It can promote industrialization so as a result temperature of the planet becomes hotter and hotter as a result it can disturb environmental sustainability

In conclusion, external factors like CO2 emission, FDI, Remittance Population, and Imports strongly influence Pakistan's environmental sustainability within its economic context. In order to maintain the balance between environmental sustainability and economic growth and achieving goals the government must adopt favourable policies for the environment and economic growth. So keeping the above discussion under consideration, the main objectives of our study are given below.

- Investigate the effect of FDI on environmental sustainability.
- Analyze the impact of remittance on environmental sustainability
- Assess the impact of impact of imports on environmental sustainability.

2. LITERATURE REVIEW

Environmental sustainability is the ability to maintain ecological balance in our planet's natural environment and to preserve natural resources to support well-being of current and future generation. It play a very significant role in life of human being. The basic aim of environmental sustainability is to improve the quality of human life without putting unnecessary risk on earth's surfaces supporting ecosystem . Following are the factor that influence the environmental sustainability. The factor include:

Microeconomic factor includes that influence environmental sustainability individual behavior such as consumption pattern, resource usages, investment decision. Firm's production method technology choices and adherence to environmental regulation also play a crucial role. On macroeconomic factor that influence environmental sustainability are government policies, trade agreement remittance, foreign direct investment, taxes policies government expenditures economic growth. So these are the factor that influence sustainability.

From these factors growth is the main factor that influence the environmental sustainability. The relationship between economic growth and environment is complex and multifaceted. While economic growth can cause to environmental degradation through increased in pollution, habitat destruction and resource depletion. It is very crucial for healthy environment for sustaining long term economic growth. Because when the economy start developments setting new industries, machineries and infrastructure so it's

not good for healthy environment. So sustainable development seeks to balance economic growth with environment conservation to ensure future generation that met their needs. Therefore symbolic relationship between environments with economic growth isnecessary for long term sustainability.

The relationship between environment and remittance is very complex. Remittance influence a receipt economy in diverse way .One side remittance can reduced the poverty it can improve gdp and financial condition in the economy. . On the other side remittance can impact negatively on economy through appreciation real exchange rate lowering labor market participation and fueling the inflation rate. It can also lead the environmental degradation through increasing purchasing power of household when the purchasing power increases the household can consume more by purchasing automobiles. So that automobiles can cause environmental pollution by emitting CO2.

The relationship between foreign direct investment and environment is complicated. Firstly foreign direct investment (FDI) can introduce new technology , resources , which can improve environmental standard through cleaner production method and technology transfer it can also cause environmental degradation through resource depletion , habitat destruction especially in those which have weak regulatory framework . The impact of (FDI) depend upon various factor such as type of industry, host country regulation,environmental management practices of investing countries.

Import and environment relation are intertwist with various factor. Importing goods can shows environmental impact through transportation process , emitting CO2from ships, planes and truck .On the other hand importing goods can be produced in countries with lower environmental standard can cause environmental pollution resource depletion ,habitat destruction . Importing also have positive environmental effect by reducing environmental burden in the importing countries when the production in exporting countries are well organized.

The relationship between population and environment is complex and multifaceted and significant. Rapid increase in population can create burden on natural resources, lead to increase in pollution and increase environmental degradation. Higher people have higher demand for food, shelter, and water, energy and living space .So as a result it can cause deforestation, and they becoming major reason for emitting CO2 carbon dioxide, depletion of resources and destruction of habitat can also cause by high population growth. On the other side of positive impact of population they bring new technological advancement, and sustainable new practices .It can also positive impact on environment through education

access to women empowerment and family planning by reduces resources consumption and

bring awareness to promote sustainable development.

Brown et al (2020) examined the relationship between settlement and CO2 emanation considering asymmetries in the setting of environment Kuznets bend (EKC) for Jamaica utilizing yearly information for the period over 1976 -2014. There are two central finding to begin with they discover the prove of altered form of (EKC) where per capita emanation take after U molded design and the moment finding settlement have negative impact on environment and on the other hand Sarkodie & Strezov (2020) examined the total impact of remote coordinate venture inflows and financial advancement, vitality utilization on nursery gas emanation utilizing the yearly information 1982 to 2016 for the best five emitter nations. In their study they uncover that FDI influx have a solid negative affect on CO2. It increases the CO2 emission. In the finding bolster the EKC and populace paradise theory which centers on feasible advancement in arrange to diminish emanation.

Sung et al. (2018) investigate how remote coordinate venture inflows influence the CO2 emanation in have nation. In their study utilizing yearly board information 2002 to 2015 of 28 Chinese businesses subsector. In their result show that FDI inflows have positive affect on natural quality. On the other side Karasoy (2021). They explore coordinate and circuitous effect of settlement on natural maintainability in Philippines. In this ponder financial development, vitality oil utilizations are critical effect on natural maintainability. It diminishes natural maintainability. On the other hand settlement are exceptionallyreduce impact in short run but their effect on short run are critical. They are by implication impact the natural supportability in Philippines.

Ahmad et al. (2021) investigate the relationship between settlement and natural maintainability. In their study they appear the positive and negative stun in the settlement. Concurring to their think about they suggest positive stun settlement has bigger affect as compared as to negative stun. Boutabba,.(2014) also looks at long run relationship between CO2 emanation , Gdp per capita , vitality employments , trade openness and monetary improvement .In their study they discover that trade openness has immaterial affect on short but critical effect on long run . On the other hand Jayanthakumaran, et al (2012). Examine the comparative investigation between CO2 emanation, vitalityutilization, exchange and salary of China and India. In their study they uncovered that trade can decrease outflow in China short run. Whereas on the other hand they fizzled to draw picture with respect to basic changing and CO2 in India. Mominur& Halim, (2022). Investigate the impact of exchange adjust, green field speculation, financial development, vitality utilize money related

improvement, and urbanization on natural supportability in BRICS nations. In their study they investigate about proportion of purport and send out have negative relationship on

natural supportability. On the other hand nursery fieldventure can move forward natural supportability and exchange adjust can too move forward living standard and natural condition.

Nawaz (2018) talked about the vitality security for socio and financial and natural maintainability in Pakistan. In their study they investigate the energy Frailty is harming for environment and financial socio condition in Pakistan. Since Pakistan reliance's imported vitality assets so they discusses about propose long run vitality security to accomplish socio and natural maintainability in Pakistan. On the other side Rahman et al., (2021) investigate the effect of CO2 outflow on populace development and nourishment generation, vitality utilization in Pakistan. In their study they revealed that the long run connection of populace development on natural supportability in Pakistan whereas the other variable like nourishment generation vitality utilization too long run effect on naturalsupportability in Pakistan the effect of these variable are long run as compared to short run. Ahmed et al, (2022). Also investigate the part of political institution in environmental impression or natural supportability in economy .They revealed that the part of political institution in natural supportability is long run not short. They conclude that they are a critical driver of natural maintainability.

Rahman et al, (2022) uncovered the energetic impact of renewable vitality, atomic vitality, fossil fuel vitality and carbon emanation on Pakistan's financial development. In their study, they examined that fossil fuel vitality, renewable vitality utilization, and CO^2 emanation have noteworthy effects on financial development in Pakistan in short run, not long run. Mushed (2020) talk about the experimental examination nonlinear effect of ICT trade openness on renewable vitality move, vitality effectiveness, clean cooking fuel, and natural maintainability in South Asia. They revealed that ICT trade specifically affects the renewable vitality utilization by advancing renewable vitality offers,cleaner cooking powers and lessening carbon emanation. On the other hand Ali et al, (2020). Investigate the relationship between settlement, common assets, mechanical progression, financial development and natural maintainability in Pakistan. In their study they inspected the effect of settlement on CO2 outflow is long run. On the other hand innovative headway common assets and financial development can moreover increments the CO2 outflow.

Rahman et al, (2007) investigate the affect trade openness on natural supportability in economy. In their study they examined the effect of trade openness on natural supportability gets to be when the open economy ended up purport cleaner innovationsand occupy generation from soil to clean division. Whereas Sharma et al, (2022)

investigate consequence act as a catalyst for environmental foot print in BRICSeconomy. They examined about inspected moment gets to be increments the environmental foot print or CO2 emanation their last result demonstrate that moment gets to be major driver carbon outflow in long run Mohsen et al,(2019) uncovered the coordinates impact of vitality utilization, financial improvement, populace development on CO2 based natural debasement in case of transport sector. In their study they revealed that increment in financial growth urbanization, vitality utilization increment transport based natural debasement. They examines the vitality utilization per capita and CO2 emanation endedup positive connection.

Khan et al, (2022) examined the relationship between natural advancement and exchange openness and quality institution with natural supportability. In their result discover that exchange openness, vitality utilization, outside coordinate speculation are adversely related with the carbon outflow. So on the other hand most of the quality institution are altogether commitment of natural supportability. On the other hand Mukherjee,Chakra borty, (2012). Investigate how exchange and venture influx influences natural supportability utilizing board information. In their study they examines remittance and FDI are contrarily related with natural maintainability in long run so be that as it may exchange and speculation influx essentially impacts the natural maintainability.

Malik et al,(2020). Investigate the symmetric and deviated effect of oil prices, FDI,financial development on carbon emanation in Pakistan. They examines that FDI, financial development can increment carbon outflow in both long run and short run.Whereas on the other hand oil costs can heightening emanation in short run and gotten to be diminishes outflow in long run. On the other side Rahman et al, (2021). Considered the Hitler kilter examination to investigate energetic effect of carbon emanation to renewable energy expenditure, remote coordinate investment and exchange in Pakistan. They revealed that FDI have positive as well as negative variety to debase environment. whereas on the long run result show that there will be the coordinate affiliation descendingslant in renewable vitality and CO2 emanation implying contamination level diminishes whereas the upward slant irrelevantly positive drift.

Hasaballah et al, (2018) investigate the determinant of natural maintainability in Saudi Arabia. They examines that money related advancement, per capita wage, FDI emphatically contributed to the natural corruption. Kayani et al, (2020). This study

investigate the causal connections between globalization, urbanization, money related improvement, utilization of renewable vitality and outflows of CO2. In their study revealed that FDI, urban populace, are long run positive relationship with CO2 outflow. Whereas renewable vitality utilization are contrarily relationship with CO2 emission. On the other side Imran et al, (2022) investigate the vitality utilize and innovation affect in QUAD (Japan, Australia, India, US). In their findings they revealed that renewable vitality generation and innovative headway improves the natural maintainability in the nations. Whereas the utilisation of nonrenewable vitality assets and financial development compound it.

From the past studies they examining generally around inner variables that influence natural supportability in the economy. So in this study discuss about external components that influence natural maintainability in Pakistan economy and analyze the long run and short run combined impact of all autonomous factors

3. DATA & METHODOLOGY

Time series data from the World Development Indicator (WDI) for the period of 1980 to 2022 for analysis has been used. All the data on variables are in percentage form and FDI is taken as net inflow in percentage of GDP. Here is the model that show the impact of external factor on environmental sustainability inPakistan

$$ES_t = \beta o + \beta 1\ in(FDI_t) + \beta 2\ ln(Imports_t) + \beta 3\ ln(REM_t) + \beta 3\ ln(pop_t) + \mu_t$$

ES = inverse of carbon emission

Bo= intercept

FDI= foreign direct investment (net inflow)

Imports = Total imports

REM = foreign remittance

Pop = total population

μt = error term

Carbon dioxide is a colorless odorless and nontoxic gas that formed by the combustion of carbon and respiration process of the living organism. It is considered as greenhouse gas. Emission can be defined as it is derived from burning of fossils fuels and manufacturing of cement they include CO2 produced during, combustion of automobiles fuels. Pakistan is one of the bigger carbon emitter in the world. It can show great impact on the environment and human lives. It can increase the earth's temperature. It leads to global warming and climate change. Warmer temperatures change over time changing weather patternsand disturbing the balance of nature.

Foreign direct investment can be defined as it is an investment made by the company in one country into business interest located in another country. It can promote economic growth and development. It can impact positively and negatively on the environment. On the positive impact it can promote economic development and become boom in theeconomy. On the negative impact it can lead environmental degradation resource depletion and create pollution. While remittance is a transfer of funds from one country to another country. In the country of Pakistan most of the people are doing jobs in foreign countries so they send money to home country. It show great impact on the economic growth and development and increases the purchasing power of the people and increasethe living standard of the people. On the other hand it show negative impact on the economy it can lead environmental degradation and major cause of carbon emissionthrough people purchasing automobile.

Imports are the good or services that can bring into country from foreign country. It can show great impact on the environmental sustainability through transportation process it can emit carbon emission in the atmosphere. It can pollute the environment and resources depletion. On the other hand, it can show positive impact on the environment by reducing burden in the importing countries when production in the exporting are well organized. Population can also show a great impact on environmental sustainability. Rapid population increases show the higher demands of basics necessities such as food, shelter, and clothes. So as result it can lead environmental degradation resource depletion and carbonemission. On the other hand, positive impact it can introduced technological advancement, new technological skills.

4. RESULTS AND DISCUSSION

Before starting the analysis, we checked stationarity of the data using unit root test. Here the results of unit root.

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Table 4.1: Unit root test results

Variables	Test statistics	Probability	Order of Integration
Carbon emission	**-4.3966**	**0.0011**	I(1)
Remittance	**-5.688**	**0.000**	I(1)
FDI	**-3.024**	**0.040**	I(1)
Population growth	**-5.081**	**0.002**	I(1)
Imports	**-5.15**	**0.0001**	I(1)

Since all the probability values are less than 5% so all the variables are stationary at first difference. We used the Johannson co-integration test to examine the co-integration between variables.

Table 4.2: Johansen cointegration test:

Hypothesis	Eigen value	Trace statics	Critical value	Prob value
None	0.672	92.795	69.818	0.0003
At most 1	0.457	48.171	47.856	0.046
At most 2	0.321	23.729	29.797	0.212
At most 3	0.185	8.233	15.494	0.440
At most 4	0.000	0.012	3.841	0.912

In Johansen cointegration, the trace test indicates that two cointegrations exist in the above results.

Table 4.3: Long Run results

Variable	Coefficient	t- values	P-value
FDI	-0.209	-3.051	0.004***
Imports	0.451	2.755	0.018**
Population growth	0.443	1.950	0.043**
Remittance	-0.062	-0.904	0.243

In the long run result, FDI can significantly impact on carbon emission. When FDI increases it can reduce CO2 emissions. When FDI increases by one percent the CO2 can be reduced by 20%. According to the study of Mukherjee and Chakraborty, (2012) when countries start development projects to other countries, they can transfermodern technology which can be friendly to the environment so its impact on environmental sustainability will also long run. So that's the reason the impact of FDI is long run.

When the imports increase by one per cent, environmental sustainability decreases by 45%. when imports increase economic growth increases when growth increases consumption will be high which leads to environmental degradation. So that is why there are long-run impacts on carbon emissions. In the results impact of the population becomes positive with CO_2 emission. When CO_2 increases by 1% the population growth would become increases by 44%. Because population growth is a long-run phenomenon their impact will also be in the long run. It cannot increase in the short run.

The impact of remittance on CO_2 emission is insignificant in the long run remittance increases by 1% CO_2 emission decreases by 6% which is insignificant and their t-values will also insignificant less than 2. Their impact in the long run is insignificant because remittances are primarily used for immediate purposes like daily expenses and consumption etc. households may invest remittance funds in alternative income-generating activities such as small-scale agriculture or eco-tourism, which may have lower carbon footprints compared to traditional livelihoods such as logging or agriculture practices involving heavy use of fossil fuels.

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Table 4.4: Short run results:

Variable	Coefficient	T –value	P-value
Carbon emission	0.439	2.716	0.009***
FDI	-0.055	1.939	0.048**
Imports	0.138	1.424	0.543
Population growth	0.025	0.184	0.103
Remittance	-0.067	1.741	0.083*
ECT	-0.200	-2.477	0.018**

R squared	0.652
F statics	8.244

In this model, the value of R squared indicates a 65% variation in environmental sustainability is explained by FDI, remittance, imports and population growth. On the other hand, the value of F-statics indicates that their value is significant which means that there is at least one variable that has a significant effect on the inverse carbon emission.

Foreign direct investment has a significant impact on environmental sustainability in Pakistan. Its value is significant at 10% level and there is a negative relationship with CO_2 emission in the short run. When FDI increases by one per cent the CO_2 will increase by 19% at lag 2. Because according to the study of Rahman et al FDI can impact CO_2 emission negatively in the short run. It depends upon various factors such as the nature of investment and when the home country invests abroad they face some restrictions regarding clean environment so that's the reason. Imports are significant at lag 2. When imports increase by 1 % while the imports increase 13%. There will be a positive relation with CO_2 emission. According to the study by Sharma et al. (2015), the import will have a positive relation with CO_2 in the short run when we use transportation, automobiles, trucks they can emit the CO_2 in environment. Population growth become insignificant in short run. When population growth increases by 1% while CO2 emission increases by only 2% which is insignificant. There are no impact on the environmental sustainability in short run because it is a long run phenomena so there impact will be the long run. It cannot measured in short run.

Remittance can impact significantly on CO2 emission in short run. When remittance increases by 1% the CO2 increases by 17% which is significant because remittance can mostly use for primarily purposes which is short run.

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Table 4.6: LM Test

Lag	LRE- Stat	df	Prob	Rao F-statics	df	Prob
1	26.38	25	0.387	1.06	(25,75,8)	0.39
2	31.24	25	0.177	1.30	(25,75,8)	0.18
3	23.38	25	0.554	0.93	(25,75,8)	0.56

If the p-value is greater than the significance level i.e. 0.05 we reject the null hypothesis. In the model, there is a serial correlation. On the other hand, if the p-value is less than the significance level of 0.05 we accept the null hypothesis in the model there will be no serial correlation. In lag 1, the p-value is greater than the significance level (0.05) which is 0.3872 so we accept the null hypothesis as a result there is no chance of serial correlation in the model.

For Lag 2 and 3 the p value is also greater than the significance level. So it indicates there is nochance of serial correlation in the model. In this case, we also accept the null hypothesis. From all the above results there is no serial correlation in all the variables.

Table 4.7: VEC Residual Normality Test:

Component	Jarque – Bera	Df	Prob
1	0.063	2	0.9686
2	1.219	2	0.5435
3	0.010	2	0.9948
4	3.818	2	0.1482
5	0.301	2	0.8602

If the p-value is greater than the significance level that is 0.05 so we accept the null hypothesis and as a result, residuals are multi-variant normal. On the other hand, if the p-value is less than the significance level of 0.05 we reject the null hypothesis and residuals are not multi-variant normally distributed. From the given table all the p values are greater than the significance level so we accept the null hypothesis and as a result, all the residuals are multi-variant normally distributed in the model.

5. CONCLUSIONS AND POLICY RECOMMENDATION:

This study discusses the external factors that affect environmental sustainability in Pakistan's economy and investigates the long-run and short-run impact of these factors on environmental sustainability. Time series data from 1980 to 2022 has been used. The conclusion of the unit root tests suggests that the data is stationary at the first difference for all the variables whereas the finding of the cointegration test shows long-run relationship between variables. In the long run, population growth and imports have a positive relationship with carbon emission while on the other hand, FDI is negatively related to CO_2 emission. While remittances have an insignificant impact long run they have a significant impact in the short run.

Based on the empirical findings this study suggests several policy implications to policymakers, higher authorities, and government regarding environmental sustainability. The positive influence of imports on environmental sustainability so the government can identify this product that causes CO2 emissions, implement tariffs on these products promote that product and import that products that are environment friendly. Secondly, in FDI the government promote industries which are environmentally friendly and makes their product which are environmentally friendly and promote sustainable practices. Thirdly remittance can impact positively on the environment so people impose taxes on automobiles because on remittance the demand for automobiles becomes high that's why tax can reduce their consumption and bring awareness among people to invest in sustainable projects that make the environment clean.

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