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The Importance of Renewable Energy Consumption and Human Capital in Attracting Foreign Direct Investment in Pakistan

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ABSTRACT

This research looks at the connections between FDI, renewable and nonrenewable energy, human capital, and the environment in Pakistan. Using data collected from 1998 to 2020, this study uses the autoregressive distributed lag (ARDL) method to quantify the interdependencies between various conceptual frameworks. All variables tested had a significant impact on FDI in the long run. The environment coefficient is significantly negative. In addition, there is a positive indication of significance for the coefficients of renewable energy, non-renewable energy, and human capital acquired through formal education. Based on the findings of this research, it is recommended that national governments take steps to attract more FDI.

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1. Introduction

Direct investment from abroad (FDI) is a crucial contribution to the economic development and growth in an industry, specifically when the country's savings aren't sufficient to meet the demands of its speculation (Chaudhry et al., 2020). It provides a means for the transfer of cutting-edge innovations to horde country and may provide work for both highly qualified professionals and those with less formal education (Demena and Bergeijk 2019). As an added bonus, foreign direct investment (FDI) promotes business growth, which boosts productivity and, in turn, the host country's economy. (Lee 2013; Shahbaz et al., 2015). Despite these positive effects on the horde country, FDI may sometimes have unintended consequences for the environment. (Zhu et al., 2016). Rising carbon dioxide emissions can cancel out the benefits to economic growth from higher levels of foreign direct investment. This could be a reason to be concerned when considering the environmental implications of a growth in economic activity fueled by FDI (Shahbaz et al., 2018). However, America is the only country that produces the highest level of CO2. In 2017, the US was second-highest emitter of carbon dioxide, at 5.27

billion metric tons. That's equivalent to 14.6% of environmental damage worldwide. The United Nations Climate Change Conference, held in Doha in 2012, set a goal of reducing emissions by at least 18% from 2013 to 2020 compared to 1990 levels (Chaudhry et al., 2021).

The global pandemic has created destruction on the lives of people around the world over a year since the first coronavirus was discovered. The economic, social environmental, and health effects could be similar to be the same as last year's when public health measures are successful in helping minimize its impact (Zhao et al., 2022). Global efforts to tackle social and environmental issues have been hampered by the spread of the disease and its associated effects that have slowed progress towards a variety of UN Global Compacts Sustainable Development Goals (SDGs) in 2030. This is why several countries are pushing for green development" to focus on sustainability and conservation while also focusing on economic prosperity in light of these converging circumstances (Raihan et al., 2022, Xu as well. 2022; Faheem et al., 2019). The New Green Deal promotes innovation and provides a sustainable approach to protecting the environment as well as resource usage and the growth of green. The conventional concept of sustainable development is broad and long-term (You & Xiao, 2022). From this angle the pressing environmental issues have led to a continuous discussion about the growth of economics, green financing and the quality of our environment (Aslan et al., 2022, Mehmood,2022). Sustainable development can be achieved through the implementation of green growth strategies that cause little or no impact on the environment (Tugcu (2018)). Efficiency in energy use as well as renewable power are crucial aspects of these strategies. They are aiding in the transition to sustainable development by cutting greenhouse gas emissions resulting generated by fossil fuels (Raihan et al., 2022). The effects of global warming have become a major issue for nations across the globe. Global warming is a cause of problems like drought, hunger, and a variety of illnesses(Faheem et al., 2021).

Environmental economics all over the world place a high priority on the discussion surrounding fossil fuels, renewable energy sources, and the environment. Currently, the dynamics of renewable energy have given rise to a number of entirely new concepts, such as trade openness, economic growth, and technological improvement. Links between energy use and gross domestic product as well as the openness the energy and trade markets offer a fascinating area of study(Faheem et al., 2020).Governance is also significant in influencing the quality of the environment. Environmental regulations that are strict or flexible influence the use for traditional sources of energy. Numerous research studies have looked into the effects from governance and environmental protection however, they are unable to give consistent results. In addition, there is a dearth of studiesthat investigate the relationship between governance and FDI within a group of South Asian economies (Kostakis et al. 2017).

One of the main causes for climate change is usage of the use of non-renewable energy (NRE) sources that emit carbon dioxide (CO2) throughout the environment. The environmental pollution caused by NRE use, is a major cause of global warming. NRE is a major cause of negative effect on the life duration. In the UN, through the (SDGs) attempt to decrease carbon dioxide and attain carbon neutrality by 2030. The renewable energy (RE) is regarded as being the best alternative source of energy and is therefore, greener due to its negative effect in carbon emission (CE), (Akpanke et al., 2023). Study by Ahmad and co. (2004) Future primary energy sources would be sustainable resources like solar hydro, wind and tidal. These sources could be used to replace non-renewable energy sources and the carbon emissions would be significantly reduced. Reduced carbon dioxide emission has been made an international priority (Faheem et al., 2022). Nathaniel et al. (2020) observed in their prior research that commerce, FDI, and energy use all had an unequal relationship over the long term. Studies have indicated that host countries' energy usage rises as a result of FDI. FI and trade

transparency also aid economic growth when renewable energy sources are used. However, the relationship between expanding economies, internationalization, and renewable electricity sources has not been thoroughly explored. Long-term and short-term goals are set for this study to determine whether or not there is a correlation between financial growth, globalization, and FDI and the use of renewable electricity. As a result, Tariq and his team will be better equipped to make both immediate and long-term strategic decisions because of a deeper grasp of fundamental relationships.

Human activities that are geared towards expanding economic growth threaten the current ecosystems in both nations (Bekun et al., 2019). Global warming is a cause of changes in the climate and is a global issue. Every country is affected by these unintended effects that have inspired countries and global initiatives to tackle the problem. Recent research has shown that consumption and production that is not sustainable result in destruction of the environment and climate change (Ahmed and Wang 2019. Ahmed et al., 2020b; Omojolaibi, and Nathaniel 2020).

Climate change caused by humans often threatens our capacity to survive on the planet (Chishti et al., 2020a, b). If we do not drastically reduce the amount of carbon dioxide emissions (GHG), the dangers of global warming and climate change could harm human societies and also hinder the sustainability of the planet via increasing temperatures and acidification of the ocean, pollution of the air and cyclones. While a variety of studies have examined the individual reasons for CO2 emissions, this study is aimed at finding out how economic variables affect the emissions of CO2 in Pakistan in general. The energy needs of Pakistan are projected to grow by three times over the next few years. In a large way the wind power sector is the fastest growing sector of the renewable energy industry (Farooq et al., 2023). It has positive impacts on the expansion of a country, productivity and consumption of energy by maintaining a healthy economic economy. Production of wind power in Pakistan is a viable option particularly in the northern regions of Pakistan and along the coast strip.Capital-strengthening technologies, foreign exchange, imports, and better general productivity can all play a role in making international direct investment (FDI) and Human Capital (HC) essential to long-term economic growth. Both of these have played crucial roles in the recent decade of economic growth in the ECOWAS area (Blomstrom and Kokko, 2002). Foreign direct investment (FDI) is significant and crucial to the continued economic growth of ECOWAS member states. Foreign direct investment (FDI) flows are crucial to the development of West Africa because they boost domestic savings, increase employment opportunities, facilitate knowledge transfer and technological advancement, and boost productivity and competitiveness. (Anyanwu, 2011). Human capital is a key component of Total Factor Production (TFP) in Solow's Solow growth model, and TFP is responsible for the residuals that are not accounted for in other models. (Solow, 1957). Skills, knowledge, and abilities, together with ideas and good health, are all aspects of human capital that contribute to an economy's overall production. Economic growth may be sustained if people have the skills, knowledge, health, and stamina to do their jobs effectively and creatively (Farooq et al., 2022). In an endogenous model of economic growth, Wu et al. (2022) hint at the importance of dynamic and the interaction of other variables beyond FDI and HC in the pursuit of sustainable economic development. Renewable energy development and financial growth are linked, according to Wu et al. (2021). Theoretically, renewable energy could affect the link between FDI, HC, and sustainable economic growth.

There is no definitive answer to the question of how FDI affects the environment. The pollution haven theory proposes that foreign direct investments (FDIs) are lured to countries with lax environmental rules since doing so will raise emissions and, in turn, improve environmental quality. (Naughton 2014; Cole and Fredriksson, 2009). In contrast, the PHH postulates that eco-friendly green technology will be used by foreign investors to improve environmental quality. (Huynh & Hoang 2019).

According to the PHH, if the host country relaxes its environmental policies, it may see an influx of foreign direct investment (FDI) from multinational businesses that will expand output, releasing more carbon dioxide and other pollutants into the atmosphere. (Huang et al., 2022). The PH, on the other hand, mandates that FDI-engaging multinationals use cutting-edge, energy-saving technology, advanced management strategies, and environmentally responsible business practices in order to enhance the environment of the countries where they set up shop. (Ren et al., 2021, Mert and Caglar 2020; Bakhsh et al. 2017). When multinationals use cutting-edge technology in the production process, carbon emissions and energy intensity are expected to drop as a result of FDI (Lee, 2013).

2. Literature Review

Foreign direct investments impact on greenhouse gas emissions has become a contentious issue in current year. In theory, the dominating dimension determines whether FDI has a good or negative impact on the global environment. (Shahbaz et al., 2018). There have been numerous attempts to assess how the recent surge in FDI might affect the natural world. There are two competing ideas on the connection between foreign direct investment (FDI) and carbon emissions, and these studies highlight the need of distinguishing between them. There is, on the one hand, adequate evidence to back up the idea of a pollution sanctuary. (Demena and Afesorgbor in 2020a; Qamruzzaman, 2021). According to this idea, countries with stricter environmental regulations lose competitiveness against countries with fewer restrictions, since polluting enterprises leave the former for the latter. (Xie 100 & Zhang, 2021). It's easy for other countries to lower their environmental control standards while competing with us for resources on the global market, and this can start a vicious cycle of deterioration for our environment. (Y. Wang et al. 2021a).Concerns about the 174th global pollution and climate change highlight the need to boost the use of renewable energy (Azam et al., 2021; Doytch& Narayan, 2016). The decline of natural resources as well as the environmental effects are gradually forcing nations to shift to more sustainable sources of energy. The literature on energy economics has previously studied the relation with carbon dioxide emissions as well as the consumption of renewable energy using various methods of estimation (Raihanet al., 2022). The studies used diverse indicators, such as the consumption of electricity as well as the utilization of resources, trade openness as well as urbanization, financial development and technological advancement in order to analyze the effect of these elements upon the EKC. Growth in energy consumption as a result of industrialization can be detrimental to the environment, however this negative effect could alter due to the rapid growth of renewable energy use (Djellouli and co. 2022, Raihan et al., 2022).Apergis et al. (2012) focused on a specific geographic region; Eurasia was a period which covered the years 1992 through 2007 and proved that the theory of reaction was valid for the consumption of renewable energy. Apergis and Payne investigated Central America and explained the short and long-term feedbacks and the increasing impact from renewable energies. Utilizing the data from 35 years collected from panels, WoldeRufael and Yemane identified a link between the evolution of economics and the depletion of electricity. Wolde-Rufael, Y. (2014). A number of scholars have tried to comprehend the connection between economic growth and the energy consumption during the month's period. Abosedra et al. (2013) who selected 82 countries between 1972 and 2002 Based on four income levels, and gave insufficient evidence for the theory of growth. Omri (2013) obtained data from 65 countries between 1990 until 2011. Omri (2013) analyzed data from 65 countries between 1990 and using an income per head, and confirmed the theory of feedback and growth in middle- and low-income states.

Many studies study the renewable and CO_2 emissions connection. The results of these studies generally show it is eco sustainable (Balsalobre-Lorente et al., 2021). But, a handful of studies have shown that renewable resources don't reduce pollution, and the reason could be ineffective or insufficient use (Pata as well as Caglar 2021). Foreign direct investment could be a factor in the growing

pollution nexus via two ways. The first is that FDI can result in an increase in output for the nation and this can increase pollution and thus proving the validity that the PHH is valid. The second aspect is that a reduction in the amount of pollution is possible by utilizing efficient production techniques due to the FDI (Lau et al. 2014). There isn't a consensus among research studies on the connection to FDI as well as the environmental. Certain studies claim that FDI causes environmental degradation; it is believed that the PHH hypothesis is plausible (Rahman and co. 2022) and others assert that the reverse is true (Zhang et al., 2022).

Contribution of human capital in the magnetism of FDI is being studied both theoretically and practically. The FDI that is aimed at the outside is discouraged due to lower levels of human capital due to the fact that the physical capital becomes less efficient when there are lower level of the human capital. One of the first theoretical researches is by Lucas (1990) that employs neoclassical expansion models in order to clarify the reason capital flows do not move from wealthy to poor countries, and argues that the human capital plays a crucial factor. Similar to that, Zhang and Markusen (1999) demonstrate that as the availability of skilled labor in the host country decreases and FDI inwards converges to zero. They propose a model to show that the supply of skilled labor force in the host country is an essential "direct requirement" of multinational corporations. Miyamoto (2003) proves that an increase in human resources creates an environment conducive to foreign investment, which is achieved through the direct impact of improved capability and the indirect consequences of health and stability in society. Borensztein et al. (1988) mention that human capital plays a crucial role in determining the ability of host countries to absorb technological advances which may occur as a result from FDI inflows.

3. Data and Methodology

The data collected in this study look at the effects of FDI to renewable power, non-renewable human capital, EC as well as CO2 emission. The data comes from World Development Indicator (WDI) and BP statistics. The range of data spans from 1998 to 2020.

To study the collision on FDI and consumption of energy and human capital models for CO2 emissions are described. The model's specifications are provided in the following manner:

The relationship could be written in the form:

FI = f(RE, NRE, SE, ENV)

In the following:
FI= Foreign direct investment
RE= Renewable energy
NRE= Nonrenewable energy
SE= School Enrollment (Human Capital)
ENV= Energy consumption (CO2 emissions)

$$FI_t = \beta_1 + \beta_2 RE_t + \beta_3 NRE_t + \beta_4 SE_t + \beta_4 ENV_t + \beta_5 x_t + \mu_i$$

Using the aforementioned model, one would expect standard theory to predict that β2, β3, β4, β5, and β6 are all positive. In addition, a Gaussian distribution is assumed for the error term. When considering renewable energy, nonrenewable energy, human capital, and CO2 emissions, the elasticity of FDI is given by the coefficients β2, β3, β4, and β5.

$$\Delta FI_t = \alpha_0 + \sum_{i=1}^{l} a_{1i}\Delta RE_{t-1} + \sum_{i=0}^{p} \alpha_{2i}\Delta NRE_{t-i} + \sum_{i=0}^{q} \alpha_{3i}\Delta SE_{t-i} + \sum_{i=0}^{r} \alpha_{4i}\Delta ENV_{t-i} + \mu_t$$

4. Results and Discussions

4.1 Descriptive Statistics and Correlation Matrix

The result of descriptive statistics in following tables shows the mean value of foreign direct investment, non-renewable energy, renewable energy, school enrollment (Human capital) and environment (CO2) are 20.78900, 2.206136, 3.889341, 3.593820 and 11.66941 respectively. The maximum value of foreign direct investment 22.44425, nonrenewable energy 2.442345, renewable energy 4.062016, school enrollment (Human capital) 4.093768 and environment 12.21659 respectively. The minimum value of foreign direct investment 19.31784, nonrenewable energy 2.078661, renewable energy 3.738503, school enrollment (Human capital) 3.091386 and environment 10.98580 respectively. The standard deviation value of foreign direct investment 0.902114, nonrenewable energy 0.112003, renewable energy 0.088112, school enrollment (Human capital) 0.259931 and environment 0.356758 respectively. The correlation matrix shows the association between the variables which are used in the study.

Table1: Descriptive Statistics and Correlation Matrix

	LFI	LNRE	LRE	LSE	LENV
Mean	20.78900	2.206136	3.889341	3.593820	11.66941
Median	20.83481	2.168202	3.870367	3.583565	11.70907
Maximum	22.44425	2.442345	4.062016	4.093768	12.21659
Minimum	19.31784	2.078661	3.738503	3.091386	10.98580
Std. Dev.	0.902114	0.112003	0.088112	0.259931	0.356758
Skewness	0.043647	0.763650	0.131025	-0.099214	-0.255304
Kurtosis	1.980144	2.241848	2.254860	2.455029	2.053439
Jarque-Bera	1.353312	3.755446	0.805876	0.434474	1.494069
Probability	0.508314	0.152938	0.668354	0.804739	0.473769
Sum	644.4591	68.39021	120.5696	111.4084	361.7517
Sum Sq. Dev.	24.41430	0.376338	0.232914	2.026929	3.818283
LFDI	1				
LENRE	0.6131	1			
LRENW	0.8339	-0.8318	1		
LHUC	0.0180	0.1405	0.2395	1	
LGENV	-0.8186	0.8623	-0.9854	0.2606	1

Since non-stationary data frequently produces erroneous regression results, it is vital to ascertain whether the variables analyzed here have a stationary character before employing this test. The stationarity of data can be examined with the help of the ADF (augmented Dickey Fuller) and the Phillips Peron test(Chaudhry et al., 2022). An autoregressive distributed lag model is employed to analyze the data in this investigation.

Table 2: Unit Root Test

Variable	ADF		PP	
	I(0)	I(1)	I(0)	I(1)
FDI	-2.5551	-3.7808**	-1.9833	-3.6473**
ENRE	-0.4169	-6.3955***	-0.2242	-6.3955***
RENW	-2.5143	-5.1765***	-2.5758	-5.1751***
HUC	-2.4592	-5.4609***	-2.5022	-5.5017***
GENV	0.2738	-4.9325***	0.3056	-4.9163***

Note:**,*** denotes significance level at 5% & 1%.

The long-term results demonstrate that all factors have a significant impact on foreign direct investment. Particularly, the coefficient of renewable energy is 2.632798 which is significant with a +ive sign, meaning that an increase of one percent in renewable energy will result in 0.443950 percent of international direct investments. The coefficient for environment has significant with negative sign. Coefficients for school attendance, non-renewable energy, and school enrollment are significant with a positive sign.

Table 3: Long Run and Short Run Results

Short Run Results				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFI(-1))	0.443950	0.164106	2.705266	0.0133
D(LRE)	2.632798	1.322641	1.990562	0.0597
D(LSE)	0.561569	0.161251	3.482583	0.0019
D(LNRE)	2.232225	4.258412	0.524192	0.6056
D(LENV)	-2.596424	1.238828	-2.095872	0.0484
CointEq(-1)	-0.586014	0.134734	-4.349410	0.0003
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LENRE	4.492725	2.096344	2.143124	0.0440
LHUC	1.269739	0.484978	2.618136	0.0161
LRENW	0.380272	0.206425	1.842183	0.0867
LGENV	-4.430655	2.069538	-2.140891	0.0442
C	-31.303599	50.413449	-0.620937	0.5413

The F-statistic for long-term integration is estimated to be 11.05089 which indicates that the association over time between variables, as measured by F-values are greater than the upper limit.

Table 4: ARDL Bound Test Results

Test statistics	F-statistics
Value	11.05089
K	4

Critical Value Bounds

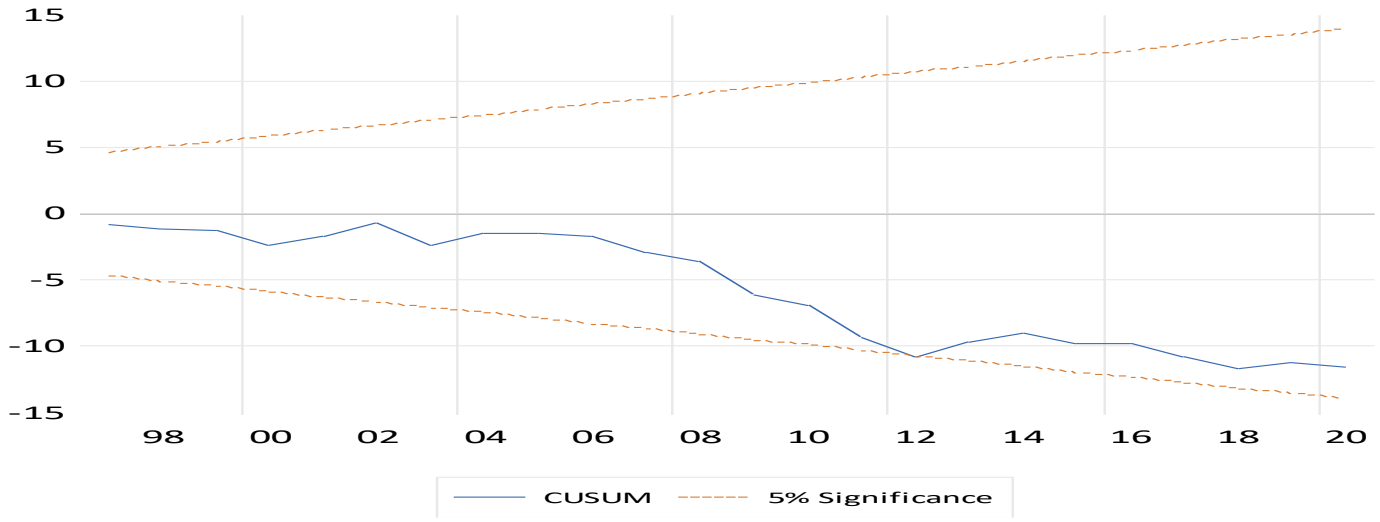
Significance	10%	5%	2.5%	1%
Upper Bound	2.45	2.86	3.25	3.74
Lower Bound	3.52	4.01	4.49	5.06

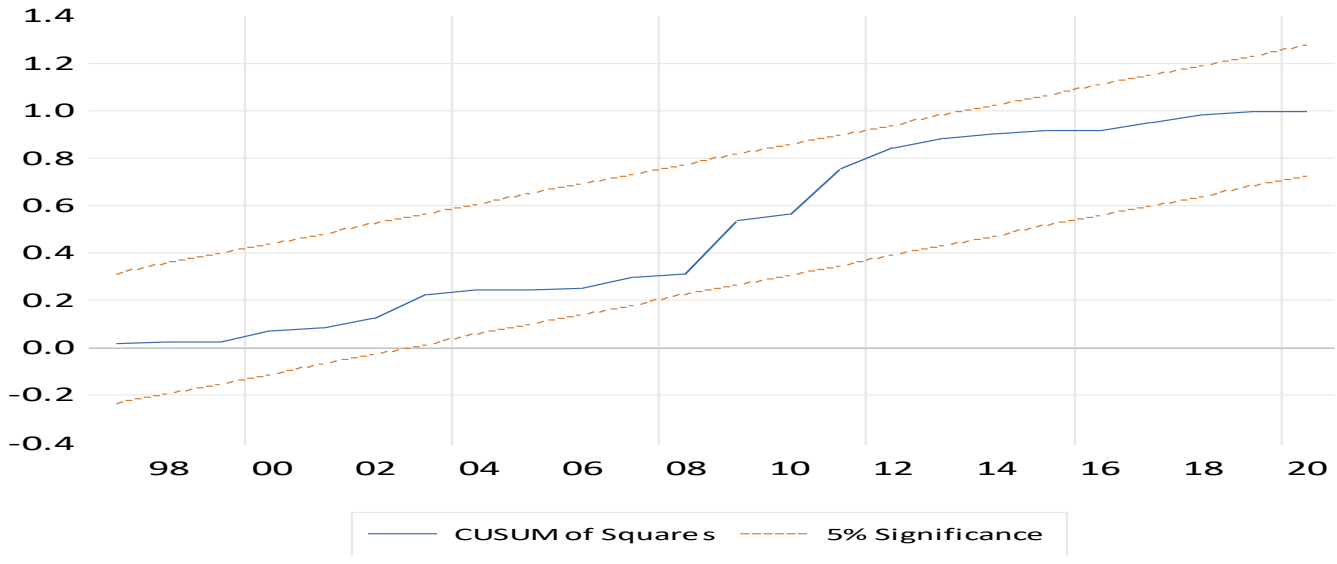
Table 5: Diagnostic Test Results

Results of the diagnostic test show that the overall the model has been stable for a long time and completely free of any major issues such as normality, heteroskadasticity, autocorrelation and stability.

R2	0.9215	Adj.R2	0.8799
D.W	2.3218	F-Stat	22.1802(0.0000)
J.B	0.3009(0.8603)	LM Test	0.2438(0.7857)
Hetero	1.3418(0.2808)	Ramsey RESET	0.8519(0.3656)

However, the result for CUSUM and CUSUMQ show that the overall the model is stable. The following figures show the results that are the result of CUSUM and CUSUMQ.





5. Conclusion and Policy Implication

This research used an ARDL (auto regressive distributive model) approach to analyze the interplay between foreign direct investment, use of renewable and non-renewable energy sources, human capital, and environmental issues in Pakistan between 1998 and 2020. Long-term connections between the variables of interest have been uncovered through co-integration testing. Foreign direct investment, renewable resources, nonrenewable resources, and human capital all show positive correlations over the short and long term. These results could be explained as foreign direct investment (FDI) between nations that are boosting their use of renewable energy over the long run.The findings from this research revealed variety potential policy implications. In the beginning, it is crucial to be aware that attracting foreign direct investment can increase which could help reduce EC and improve the environmental quality. The research suggests an investment in foreign capital that enhances human capital and energy consumption.

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