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Impact of Income Inequality and Natural Resources on Ecological Footprint Evidence from Pakistan

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ABSTRACT

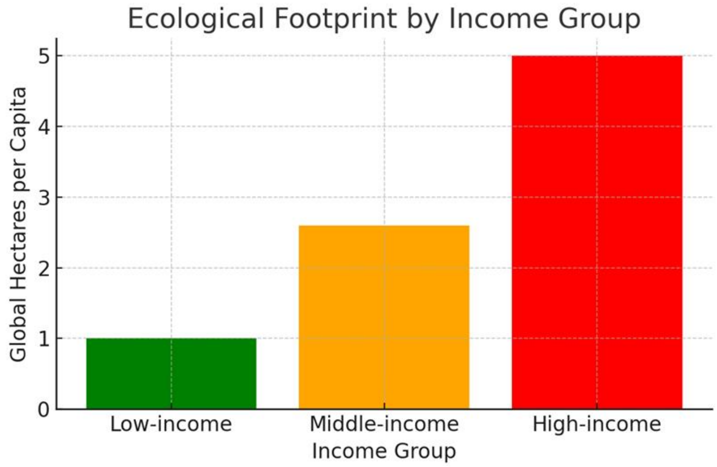
This research examines the impact of income inequality and natural resources on Pakistan's ecological footprint, using data from 1990 to 2022 from the World Development Indicators, Global Footprint Network (GFN), and the Standardized World Income Inequality Database (SWIID). The analysis is based on the ARDL (Autoregressive Distributed Lag) model, which helps identify short and long-term relationships between environmental impact and economic factors such as inequality, natural resource use, GDP, and foreign direct investment (FDI). The findings show that while all variables are stable over time, they are linked in the long run. Income inequality, GDP, and FDI each have a mild positive association with the ecological footprint, meaning they slightly increase environmental pressure. Similarly, natural resource use also shows a slight upward impact on the ecological footprint. The study underlines the importance of policies that reduce income gaps, promote sustainable resource use, and support green technologies. Key policy recommendations include strengthening social protection systems, managing resources responsibly, investing in eco-friendly infrastructure, educating the public on sustainability, and ensuring environmental and social strategies are aligned. For future research, the study suggests focusing on regional differences, specific industry effects, and how behavioral changes can support sustainable growth in Pakistan.

Keywords: *Ecological footprint, GFN, SWIID, Income inequality, Natural resources, time series data.*

INTRODUCTION

Environmental deterioration along income inequality, arise as a major concern and for scholars, mainly, after the "United Nations (UN) conferences on "Environment and Development" in 2002 and "UN World Summit on Sustainable Development" in 1992 (Shuai et al., 2019). Ecological footprint shows how much biologically productive land and water area an individual, a city, a region or humanity uses to produce the resource management (Gardezi et al., 2024). Global hectares are used to express the ecological footprint. According to Afridi et al. (2019), both established and emerging nations have seen rapid urbanization, increased per capita consumption of goods and services, and robust economic development in the last four decades. This shift, according to ecologists and environmentalists, has exacerbated environmental disasters (Hannigan J. 2022). While the earth's regenerative ability is outpacing human resource use and residual emissions, the global population has surpassed 7 billion in the last century (Dunlap et al. 2022). Over the last quarter of a century, the world's natural resource extraction has increased by 45 percent (Oberle et al., 2019).

Figure 1. Ecological Footprint vs. Income Group

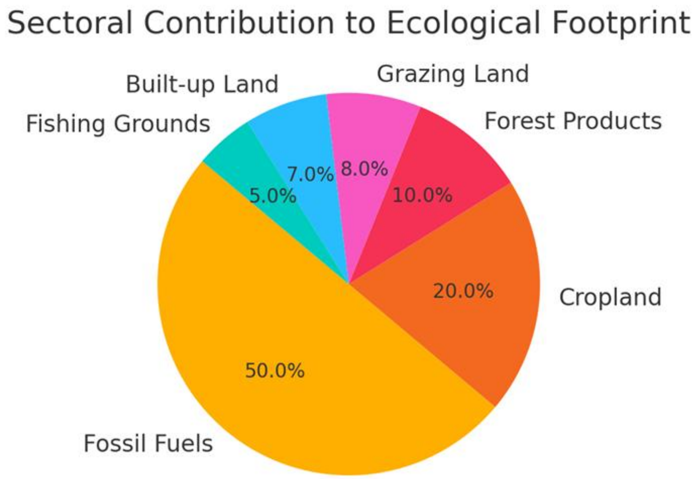


This bar chart compares the ecological footprint across different income groups, showing that high-income countries contribute significantly more to environmental degradation.

High and middle-income nations are increasingly worried about their impact on the environment due to the fact that their energy consumption has grown by over 60% to support their fast-economic expansion (Sun et al., 2020). The acceleration of food security challenges in many regions of the globe has been exacerbated by the growing trend in CO2 emissions and energy use. Also, the way people buy and us products and services has evolved due to modernization and liberalization of the market. According to environmental experts, the burning of fossil fuels, along with other causes of climate change, is speeding up the release of carbon dioxide into the atmosphere. According to (Gahlawat et al., 2020), CO_2 emissions from energy sources have climbed by 19% and are projected to reach 25–90% by 2030. Climate change and global warming are primarily responsible for a wide range of adverse effects, including changes in rainfall patterns, melting ice and snow, rising sea levels, fluctuating air and ocean temperatures, deterioration of wildlife, and decreased agricultural yields (Latif et al., 2023). According to these theories, ecologists and economists have spent the past few decades shifting the focus from conventional to green economic growth. Decoupling economic development from environmental stability and preservation, they say, is essential. (Hysa et al., 2020) found that sustainable development relies on a mutually beneficial interaction between economic growth and environmental preservation.

Greater energy consumption and material goods and service demands are two of the many problems brought about by the urbanization scenario in high- and middle- income nations. With a 250 percent spike in urban population came a 50 percent spike in energy usage (Santamouris et al. 2021). Particularly in developing and growing nations, negative externalities result from urban expansion that is both uneven and unsystematic. These regions generate over fifty percent of global carbon dioxide emissions (Solaymani et al., 2019). Scholars have examined the impact of urban areas on GDP growth, energy consumption, and carbon dioxide emissions. Nevertheless, more investigation into its impact on consuming of resources is necessary. To that end, the present research has examined the influences of driving factors by means of ecological footprint, an indication of material resource use. By 2050, the world's urban population is projected to have increased by 65 percent, driven by the trend of urbanization in middle-income nations (Farooq et al, 2020). More energy consumption has resulted from the industrialization and urbanization phases that middle-income nations are now experiencing. Coal, with its abundant supplies and inexpensive advantages, has become the go-to fuel for meeting the increasing need for energy. Nonetheless, most carbon dioxide emissions come from burning coal (Paraschiv et al., 2020). Achieving sustainable development is the biggest obstacle for nations with high-middle incomes. Sustainable development is a method of fast economic growth that takes place in an environment that can withstand the test of time. Anthropogenic activities impact energy consumption, crops, fisheries, grazing land, forestry, and built-up areas; yet, CO_2 emissions only captured a fraction of this harm (Kandil et al., 2020).

Figure 3. Sectoral Contribution to Ecological Footprint



This pie chart breaks down the various sectors contributing to the ecological footprint, with fossil fuels being the dominant factor.

LITERATURE REVIEW

Hassan et al. (2018) depicted the association between economic growth, natural resources, and the ecological footprint in Pakistan, using annual data from 1970 to 2014. The analysis reveals that NR has a positive impact on the ecological footprint, which in turn contributes to the decline in environmental quality. Additionally, natural resources support the Environmental Kuznets Curve (EKC) hypothesis. For checking both short and long-term effects, the study employs the (ARDL) model. In this model the outcome variable is the ecological footprint per Capita, and the explanatory variables are EG, natural resources, human capital, bio-capacity, and urbanization. The results indicate a quadratic correlation between EG and the EF suggesting that economic expansion positively influences the EF.

Arif et al. (2023) conclude the effect of financial development and EF in emerging countries, using annual data from Pakistan spanning 1970 to 2020. The analysis applies a non-linear Auto-regressive Distributed Lag (NARDL) model to examine that urbanization has an asymmetric relationship with ecological footprint in Pakistan, with positive changes causing more environmental degradation and negative changes causing less environmental degradation. Environmental degradation is found to be significantly influenced by industrial production and foreign direct investment, while trade openness and money supply have a negative correlation with environmental degradation. Environmental degradation and economic growth are positively correlated, although the squared term of economic growth indicates a negative correlation. The Environmental Kuznets Curve (EKC) theory for Pakistan is supported by these results. According to the report, encouraging less polluting technology and renewable energy sources is crucial to reducing environmental deterioration in Pakistan.

Uzar and ayubogle (2022) determine the relation between income inequality and ecological footprint. In this study Fourier ARDL are used to analyze the impact of ecological footprint and income inequality by using the data period over 1965 to 2017. In this study the ecological footprint used as main variable and economic growth EG, income inequality IQ and energy consumption is selected as independent variable. This analysis concludes a dynamic relation between income inequality and ecological footprint is used as an ecological indicator in the US. The experiential outcomes show that income inequality has positive effect on ecological footprint and its components like cropland, fishing ground and carbon. Income inequality increased by 1%, increasing the ecological footprint by 0.804%. The findings show that both economic development and EC have a considerable and positive impact on the environmental degradation, as well as on the components of cropland, fishing grounds, and carbon footprint. The influence of GINI symbolize income inequality in the US may result in decreased awareness of sustainability. Progressive increase in GINI improves people's economic and financial conditions. In this context, environmental concerns are often underestimated.

Khan and young (2022) depicted the relation that how to reduce income inequality and environmental sensitivity through which we achieved the sustainable development goals. This study using the data-sheet form 2006 to 2017 of 18 developing countries. The ecological footprint used as control variable and FDI, POP, access of electricity AE, income inequality GINI, inflation INF and carbon emission CO2 are used as explanatory variables. The empirical results given from (D&K) estimator confirmed the casual relationship among selected variables. By analyzing the relation of these variables according to research studies, economic disparity in least developed economies encourages manufacturers and capital owners to invest in obsolete, high-emission technology to enhance their income, thereby degrading environmental quality. The empirical data also support the theoretical paradigm that rising wealth inequality causes class inequalities between rich and poor societies, which have adverse effect on environmental quality. The rich benefit from the environment, but the poor cannot because all costs are imposed on them. According to the findings, eliminating income disparity can assist to limit environmental degradation by lowering ecological footprints and carbon emissions.

Yousaf et al. (2018) determined the relation between ecological intensity, income inequality and ecological footprint. This theory took data from 2003 to 2011 to finding the income inequality distribution in high income and low income countries. The Atkinson index suggests that wealthier countries have a higher demand for ecological resources and CO2 emissions than middle-income countries. This leads to greater differences in income per person and variations in ecological impact across different nations. The expected results of the Atkinson index indicate that a decrease in wealth inequality and environmental intensity in these nations will diminish the need for total ecological and carbon footprints, hence enhancing environmental sustainability. This study finds that middle-income countries experience more inequality in terms of per capita income and environmental impact, while high- Income countries show greater disparities when it comes to their ecological footprints relate to middle-income economies.

Zia et al. (2021) addressed the correlation among EF and other selected variables in China. This study took data from 1985 to 2018 and utilizing ADRL approach for analyzing theoretical results of available variables. In this theory the empirical results show that NR and financial development positively influences the EF in long- term assessments. Nonetheless, human capital adversely impacts environmental sustainability. The findings indicate that a 1% increase in natural resources will result in a 0.0199% rise in the ecological footprint in the short term and a 0.035% increase in the long term in China. As China utilizes more of its natural resources, it amplifies its ecological imprint and exacerbates. The positive relation indicates that China is using inefficient natural resource management strategies. The policy of utilizing natural resources argues that the inefficient use of NR is not being effectively.

Abid et al. (2021) explore the relationship between natural resources, financial development, urbanization and human capital with ecological footprint by using panel data of 118 countries over the period from 1971 to 2018. This study improves the analysis to encompass a panel of countries categorized by diverse income groups. The empirical analysis employs the (FMOLS) and (DOLS) methodologies. The findings indicate that all explanatory variables exert differing influences on the ecological footprint. Natural resources positively affect the ecological footprint across all income groups, with the exception of high-income and upper-middle- income nations. Economic growth leads to an escalation of the EF in lower and middle-income countries. Human capital contributes to increased environmental deterioration by elevating the ecological footprint across all income brackets. Globalization and energy use similarly augment the ecological footprint across all socioeconomic classes, with the exception of low-income countries.

DATA AND METHODOLOGY

This study aims to explore how income inequality and the use of natural resources impact Pakistan's ecological footprint. The information utilized in this research is collected from WDI. Time series data have been collected from 1990 to 2022. Because the research uses sequential and supplementary information, the unit root tests of Phillips Peron (PP) and Augmented Dickey-Fuller (ADF) are appropriate, Bruesch-pagan-Godfrey, ARDL Bond Test, Glejser Test, Breusch-Godfrey Serial correlation LM test are applicable. For econometric analysis, the chosen model's logarithm form is utilized, and unit root tests are employed to determine each variable's degree of stationarity. The ecological footprint uses global hectares as its unit of measurement, which enables comparative data for all countries. Income inequality is measured by Gini index as a proxy. Natural resources is measured by Natural resources rent (% of GDP). GDP is measures by constant 2015 US$ as a proxy. Foreign direct investment is measured by net inflows (% of GDP) as a proxy.

Description of Variables

Table 1. Description of variable

Abbreviation	Variable	Description	Source
EF	Ecological footprint	Ecological Footprint Accounts use global hectares as a measurement unit, which makes data and results globally comparable.	Global footprint network (GFN)
IIQ	Income inequality	Gini index	Standardized world income inequality database (SWIID)
NR	Natural resources	Natural resources rent (% of GDP	WDI
GDP	Gross Domestic Product	constant 2015 US$	WDI
FDI	Foreign Direct Investment	net inflows (% of GDP)	WDI

Economic Model

Impact of income inequality and natural resources on ecological footprint evidence from Pakistan

EF =f (IIQ, NR, GDP, FDI)..(1)

The economic modal shown that ecological footprint EF is a dependent variable and income inequality, natural resources, gross domestic product and foreign direct investment are independent variable.

Econometric model

$$EFP_t = \beta_1 + \beta_2 IIQ_t + \beta_3 NR_t + \beta_4 GDP_t + \beta_5 FDI_t + \mu_t \qquad (2)$$

METHODOLOGY

The ARDL Bond Test Long-run indicating that there are long-term correlations between these indicators. Long-run connections indicate that LIIQ has a favorable association with Ecological footprint, and LNR, LGDP, and LFDI have a positive relationship with ecological footprint.

$$\Delta EFPP = \varphi + \varphi_1 IIQ_{t-1} + \varphi_2 NR_{t-1} + \varphi_3 GDP_{t-1} + \varphi_4 FDI_{t-1} + \Sigma\, \beta_1\, \Delta IIQ_{t-i} + \Sigma\, \beta_2\, \Delta NR_{t-i} + \Sigma\, \beta_3\, \Delta GDP_{t-i} + \Sigma\, \beta_4\, \Delta\, FDI_{t-I} \qquad (3)$$

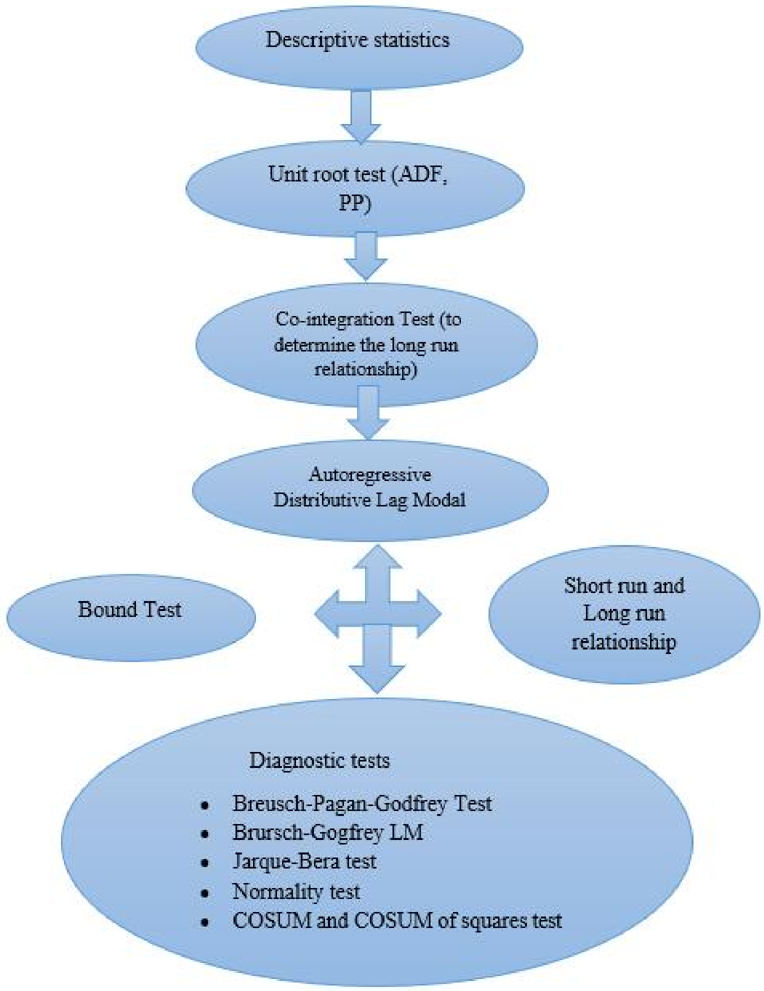
The equation above illustrates the first difference between EFP (ecological footprint), IIE (income inequality), NR (natural resources), FDI (foreign direct investment), GDP (gross domestic product) and t-1 indicates the best lag based on the Akaike information criteria. The variables Φ a nd β will be analyzed for their long-term correlation. The model demonstrates the relationship between variables; hence we will evaluate the short and long term ARDL model. The null and alternative hypothesis for the bound test is phrased as follows.

H 0 $= \varphi_1 = \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4$

H 1 $\neq \varphi_1 \neq \varphi_1 \neq \varphi_2 \neq \varphi_3 \neq \varphi_4$

The null hypothesis can be approved or refused based on the value of f-statistics. A long-run relationship exists when the p-value off-statistics is bigger than the sum of the upper and lower bond values.

Figure 4. Research Methodology



Source: Author's own plot

RESULT AND DISCUSSION

This section ensures the accuracy of the results, various econometric techniques are applied, including unit root tests such as the Phillips-Perron (PP) and Augmented Dickey- Fuller (ADF) tests, to assess the stationarity of the data. Additionally, diagnostic tests like the Breusch-Pagan-Godfrey and Breusch-Godfrey Serial Correlation LM test are used to check for potential issues like heteroscedasticity and autocorrelation.

Table 2. Descriptive statistics

	LEF	LNR	LIIQ	LGDP	LFDI
Mean	17.6514	0.6012	3.5193	26.2608	-0.2618
Median	17.6602	0.6908	3.5234	26.2594	-0.3627
Maximum	18.3012	1.0616	3.5409	26.7146	1.1104
Minimum	17.2428	-0.0352	3.4934	25.7725	-1.1724
Std. Dev.	0.2340	0.3275	0.0146	0.2877	0.6291
Skewness	0.4975	-0.4617	-0.3941	-0.1321	0.8140
Kurtosis	3.7955	1.9248	1.8417	1.9022	2.9852
Jarque-Bera	1.6230	1.9251	1.9629	1.2749	2.6509
Probability	0.4441	0.3819	0.3747	0.5286	0.2656
Sum	423.6355	13.8278	84.4646	630.2609	-6.2844

Table 2 shows descriptive analysis of results, including mean, median, maximum and minimum values for both dependent and independent variables, Jarque-Bera test, and the probability.

Table 3. Correlation analysis

	LEF	LNR	LIIQ	LGDP	LFDI
LEF	1				
LNR	-0.1582	1			
LIIQ	0.1994	-0.7835	1		
LGDP	0.3728	-0.5589	0.3868	1	
LFDI	0.1099	0.2990	-0.7081	-0.0514	1

The relationship between NR and EF is negative and weak, as seen in Table 5.2. EF indicates that there will be a 0.158 percent rise in the ecological footprint for every one unit growth in natural resources. There is a positive correlation between the value of natural resources and ecological footprint, however ecological footprint is elastic with regard to the availability of these resources. Countries lacking in natural resources will need to rely on fossil fuels like gas and petroleum to power their environmentally aware economies, according to the positive coefficient of natural resource richness (Balsalobre-Lorente et al. 2018). The ecological footprint grows by 0.199 percent for every one unit of income disparity, indicating a positive and weak relationship between the two variables (Kiran and Gardezi, 2024). In other words, GDP raises the ecological footprint by 0.372, indicating a positive and weak relationship between the two. Increasing foreign direct investment (FDI) will raise the ecological footprint by 0.109, which is a positive but weak relationship.

Table 4. Unit root test

Variable	ADF		Phillips Perron	
	Level	**1st difference**	**Level**	**1st difference**
EF	0.0009	0.0002	0.000	0.000
NR	0.3797	0.0123	0.379	0.0122
IIQ	0.0241	0.005	0.76	*0.0010
GDP	0.0455	0.0208	0.795	*0.000
FDI	0.0450	0.001	0.348	0.0014

To find out whether all of the variables are stationary, we used the unit root test, which is shown in Table 3. Using level and first difference, it confirmed that all variables were stationary. In the ADF test, the data is stationary at the 0.0009 level, and the EF ecological footprint is statistically significant at the 0.0002 level at the first difference, as shown in the table. At the level of 0.379, the data is not static, but at the level of 0.012, NR is significant. The IIQ is 0.005, which is statistically significant at the 0.0241 level of significance. At the first difference level of 0.0455, GDP is not stationary, with a significance level of 0.0208. For the first difference, FDI is statistically significant at 0.001, and the data is stationary at the 0.045 level. Table 1 shows that ecological footprint is likewise stationary at the 0.000 level of significance in the Phillips Perron test. IIQ is not stationary; it's significant at the 0.012 level of the first difference at the 0.379 level. At the first difference level of 0.760, NR is similarly not stationary, with a significance level of 0.001. At the first difference level, GDP is significant at 0.001, but it is not stationary at the 0.795 level. FDI is not stationary at the 0.348 level, but it is substantial at the 0.014 level at the first difference (Aurmaghan et al., 2022).

Table 5: Bound test

Test Statistic	Value	Significant	I(0) value	Lower I(1) value	Upper
F-statistic	7.8629	10%	2.2	3.09	
K	4	5%	2.56	3.49	
		2.5%	2.88	3.87	
		1%	3.29	4.37	

The bound test findings, which are shown in Table 4, confirm the existence of the long-run link between the dependent and independent variables. It demonstrates that there is a long-run relationship in this model as the F-statics result of 7.8629 is raises than the bottom and upper limit values. If there is co-integration between the variables, the bond test in RDL will provide light on why those variables produced those results.

Table 6: Long-run results of the ARDL model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIIQ	20.3146	10.8677	1.8692	0.0812
LNR	0.3697	0.1311	2.818	0.0137
LGDP	4.8913	2.2608	2.1634	0.0483
LFDI	0.3179	0.1670	1.9032	0.0764
C	-55.2264	36.7609	-1.5023	0.1538

Table 5 displays the ARDL model's long-term outcomes. As a result, we can see that EF grows by 20.3146% for every unit rise in income inequality, indicating a positive correlation between the two variables. Industrialization causes a great disruption in conventional economic systems and social mores, which is why income disparity is good. Income inequality can worsen as a result of this disruption because the well-off are generally in a better position to benefit from industrialization's opportunities, while low-income and marginalized communities may have a harder time adapting or may even suffer the most from its negative effects, like environmental degradation (Gardezi et al., 2024). An increase of 1 unit of natural resources will result in an increase of 0.3697% in ecological footprint, since there is a positive link between the Natural resources which have a significant and positive effect on the ecological footprint, with quantile analysis revealing a sharp decline in their impact. The extraction of natural resources, which contributes to environmental degradation, highlights the unsustainable nature of these operations. Studies by Ahmad et al., (2020), Farooq et al., (2023) and Hassan et al., (2019) support this view. Gross Domestic Product (GDP) is positively linked to environmental impact over the long term, suggesting that the ecological footprint increases by 4.8913% for every unit of GDP growth. The research also explores the relationship between economic development and the ecological footprint, noting that it may follow a U-shaped or reverse U-shaped pattern. . This indicates that the ecological footprint will grow by 0.3179 percent for every 1 unit rise in FDI. The crucial role that FDI plays in boosting productivity and supplying host countries with state-of-the-art technology might be the reason for this (Gardezi et al., 2024).

Table 7: Short-run results of the ARDL model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-54.9570	31.4991	-1.7447	0.1015
LEF(-1)*	-0.9951	0.2044	-4.8674	0.0002
LIIQ**	20.2153	8.9646	2.2550	0.0395
LNR**	0.3161	0.1400	2.2570	0.0405
LGDP	-0.0523	0.2407	0.2175	0.8307
LFDI**	0.3164	0.1349	2.3444	0.0332
CointEq(-1)*	-0.9951	0.1254	-7.9311	0.0000

As seen in Table 6, the ARDL model yielded a significant p-value of 0.000 and a CointEq(-1)* value of -0.9951. We may see that our model or economy is balanced by looking at this value. The indicator of income inequality has a positive link with ecological footprint, as shown by the significant p-values of all variables. This research looks at the relationship between income inequality and environmental impact. The data presented here indicate that income inequality rises in correlation with ecological footprint. According to Balezentis et al. (2020), the Environment is impacted by wealth inequality, which shows as a Kuznets u-inverse curve. Reduce your environmental effect by making use of natural resources. Since an example, China is the least developed nation in the world that now utilizes the most natural resources, since it consumes half of the world's coal (Aurangzaib et al., 2023). Environmental degradation and more frequent and severe weather events are direct results of this consumption. However, this may be controlled by switching to renewable energy sources from non- renewable ones; this will reduce our impact on the environment and help keep our natural resources intact (Gardezi et al., 2023). More rapid extraction of natural resources would reduce environmental biocapacity and leave ecological footprints, according to their proposal, which would be insufficient to satisfy the increasing demand. According to the findings, GDP also has a beneficial effect on environmental impact. After the notion of a Kuznets environmental curve is applied, GDP has a negative effect on ecological footprints, even if economic expansion initially has a favorable influence on environmental deterioration and a greater ecological footprint in emerging nations. Environmental degradation and ecological footprint are negatively correlated with declining GDP, according to Yang et al. (2021), due to the u-shaped Kuznets curve.

Table 8: Variance inflation factor

Variance inflation factor	Coefficient	Uncentered	Centered
Variable	**Variance**	**VIF**	**VIF**
LIIQ	72.5975	458973.1524	7.1974
LNR	0.0837	19.8529	4.3910
LGDP	0.0396	13947.1734	1.4875
LFDI	0.0162	3.5298	3.0881
C	924.1742	471969.6744	

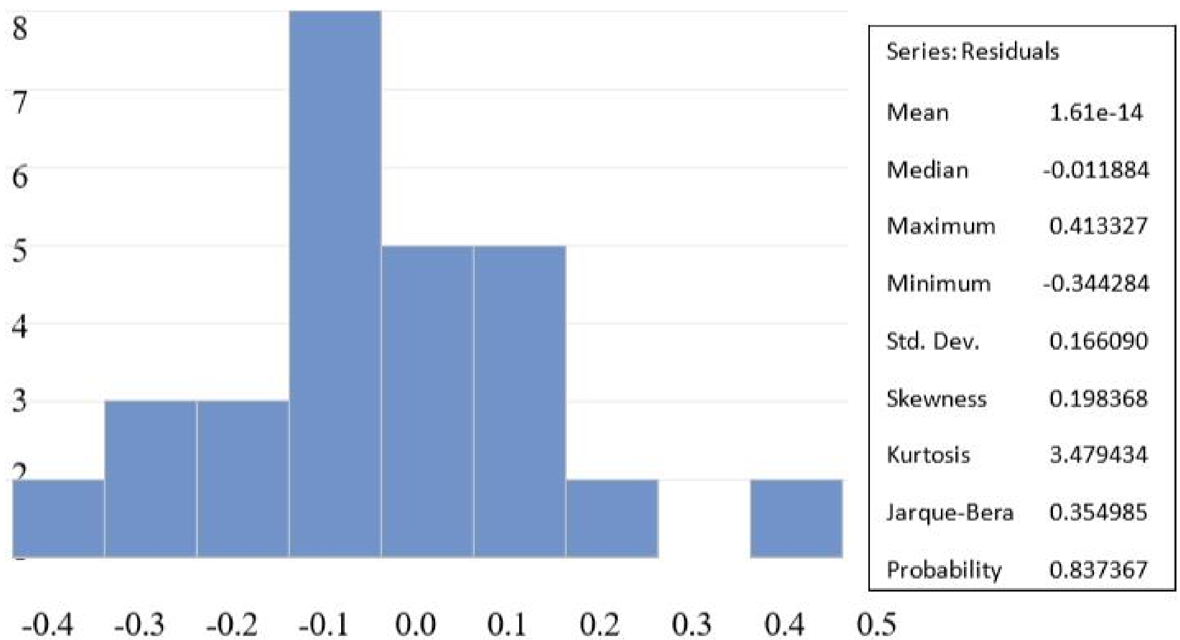
The findings of the variance inflation factor for identifying the multicollinearity issue are shown in Tables 6. The absence of multicollinearity in our data is shown by VIF scores ranging from 0 to 10. A multicollinearity issue exists if the VIF value is more than 10.

Table 9: Diagnostic test

Diagnostic test statistic	p-value	result statistic
Brursch-pagan-Godfry	0.3502	There is no problem in Heteroscedasticity
Brursch-Gogfrey LM	0.7053	There is no problem in serial Correlation
Jarque-Bera test	0.8373	Estimated residual are normal

Table 7 displays the findings of several diagnostic statistics as indicators. The results of the Brursch-Gogfrey LM, the Jarque-Bera, and the Brursch-pagan-Godfry tests all indicate that the variables are not an issue. The calculated residuals are found to be normal. There is no issue with heteroscedasticity as the F-statistic value is small, according to the test. Since none of the probability values are statistically significant, heteroscedasticity is not an issue. When the values of the variables are below 0.005, it means that the variables are not significant and have heteroscedasticity problems. Consequently, we accepted the null hypothesis (H0) and rejected the alternative hypothesis (H1). The stability of the model is investigated using the normalcy test. With a mean model of 0.3495 and a p-value of 0.837, the Jarque-Bera test indicates that the model is stable and has no problems.

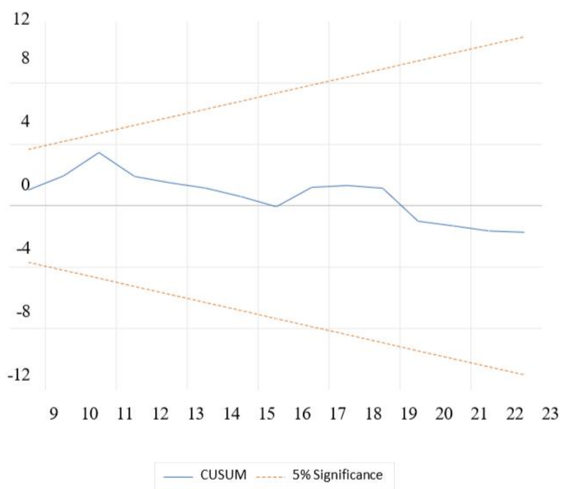
Figure 5: Normality test



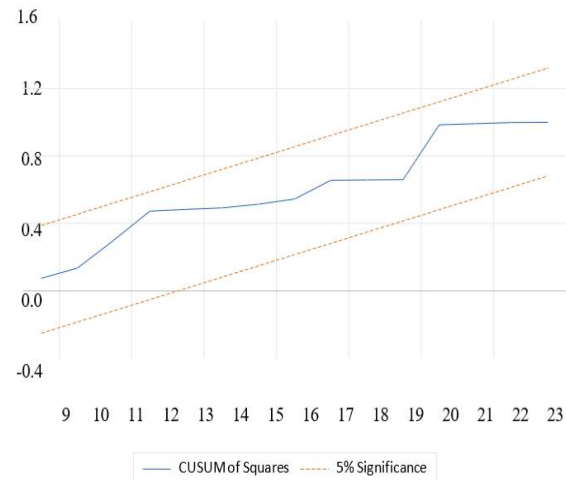
Source: E-Views output

Figure 6

COSUM test



COSUM of squares test



Source: E-Views output

CONCLUSION

This finding highlights the interaction between Ecological footprint, Income inequality, Natural resources, Gross domestic product and FDI in the background of Pakistan. This study used the ARDL technique to look for connections between the two sets of data. A descriptive study may employ natural resources, income inequality, GDP, FDI, and ecological footprint as independent or control variables, with ecological footprint serving as the dependent variable. By examining the short-term and long-term effects, the research offers comprehensive results to understand the ecological effect on Pakistan's economy. This research is based on the time series data, and the results may not be appropriate in different context. The purpose of this finding to highlight the several critical relationships between economic variables and environmental impact. Income inequality is positively linked to the ecological footprint, with every increase in income disparity leading to a significant rise in environmental degradation. This suggests that industrialization, which often exacerbates income inequality, tends to worsen environmental issues, as wealthier individuals are more likely to capitalize on industrial opportunities, while lower-income groups struggle with its negative effects. Natural resource extraction also contributes to a larger ecological footprint, emphasizing the unsustainability of current practices. Moreover, GDP growth is associated with increased environmental harm, reflecting the environmental costs of economic expansion, though some studies suggest that economic development might eventually reduce environmental damage. Foreign Direct Investment (FDI) plays a complex role, boosting productivity but also potentially contributing to higher ecological footprints due to the transfer of polluting technologies. This indicates that while FDI brings economic benefits, its environmental costs cannot be overlooked. Overall, the research underscores the need for sustainable development policies that address both economic growth and environmental preservation. The correlation between income inequality, natural resource usage, and the ecological footprint in Pakistan underscores the pressing need for comprehensive policies to achieve sustainable development while addressing environmental challenges. Tackling income inequality is crucial because it leads to uneven consumption patterns, where affluent groups contribute significantly to environmental harm through excessive consumption and resource use, while poorer communities bear the brunt of environmental risks and lack the resources for sustainable practices. To address this, policies should emphasize progressive taxation, enhanced social safety nets, and equitable access to renewable energy and green technologies. Such measures can help reduce disparities and encourage environmentally conscious behaviors. Effective management of natural resources is equally essential to prevent overexploitation and ensure ecological sustainability. The reliance on resource- intensive industries, deforestation, and unsustainable farming practices has intensified environmental issues. Regulatory enforcement on resource use, such as deforestation and mining, must be prioritized. Additionally, promoting sustainable farming methods, like crop diversification, efficient irrigation, and organic agriculture, can help preserve resources.

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