Scholars Journal of Economics, Business and Management
OPEN ACCESS
Abbreviated Key Title: Sch J Econ Bus Manag
ISSN 2348-8875 (Print) | ISSN 2348-5302 (Online)
Journal homepage: https://saspublishers.com

Environmental Sustainability and Unequal Income Distribution: A Comparative Analysis of Developed and Developing Countries

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DOI: https://doi.org/10.36347/sjebm.2026.v13i03.010 | **Received:** 21.02.2026 | **Accepted:** 26.03.2026 | **Published:** 30.03.2026

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Abstract **Original Research Article**

Worldwide researchers investigate environmental sustainability and its determining factors. Much research has been done on the EKC hypothesis, and unequal income distribution is also a determining factor of environmental sustainability, but very little research has investigated the relationship between unequal income distribution and environmental sustainability. Rich people always follow sustainable consumption, poor people depend more on the natural resources, but middle-income people follow a more energy-intensive and unsustainable consumption pattern. Therefore, unequal income distribution can affect the sustainability of the environment. Our research focused on the effect of unequal income distribution (measured by Gini inequality) on environmental sustainability (measured by the Ecological Footprint), and also focused on whether the EKC hypothesis holds for developed and developing countries. We empirically investigate 24 developed and 28 developing countries for the years 1995 to 2018. We have used a panel regression model (fixed and random effect model), and for comparison, we have used F statistic. We have found that income inequality is significantly negatively correlated with the ecological footprint in developed countries and significantly positively correlated in developing countries. The EKC hypothesis holds for both developed and developing countries. Per capita mean ecological footprint is higher in developed countries than in developing countries, and the mean Gini is higher in developing countries than in developed countries. The government should take a policy that will reduce the ecological footprint in developed countries and reduce income inequality in developing countries.
Keywords: Environmental Sustainability, Unequal Income Distribution, Panel Data, Developed and Developing Countries.

1. INTRODUCTION

In recent times, the world is facing three main problems: environmental sustainability, unequal distribution of wealth and income, and extreme levels of poverty. By increasing the level of income, a country may solve the problem of poverty, but the problem of unequal distribution of wealth may not be solved. If most of the increase in income is going to the rich people and the remaining income is going to the poor people, then the overall increase in income for every individual will increase, but the unequal distribution of income will also occur. Due to an increase in economic activity, the pressure on the environmental ecosystem will also increase, which will lead to environmental degradation. The concept of the ecological footprint—the measure of humanity's demand on the planet's biocapacity—captures the extent to which current consumption and production patterns exceed ecological limits (Wackernagel & Rees, 1996). The Earth has its own carrying capacity, so raising the ecological footprint is not problematic at all, but if increasing the ecological footprint crosses the Earth's carrying capacity, then Earth overshooting is occurring. Our present study focuses on how unequal distribution of income impacts the environment and how unequal income distribution is not only problematic for society but also problematic for the environment. Income inequality is the unequal distribution of income among the people in a society. Unequal distribution of income can impact the consumption pattern and consumption behaviour, which could impact the Ecological Footprint. Therefore, unequal resource distribution is not only a social or moral problem but also has a prominent impact on the environment.

In the existing literature, there are several studies that have been done on this topic. Theoretical and empirical studies find that unequal societies tend to create higher environmental pressure due to several interrelated mechanisms: affluent groups drive resource-intensive consumption, poorer groups emulate these lifestyles, and unequal power structures often weaken environmental regulation (Boyce, 1994; Torras & Boyce, 1998). Some empirical investigations have been done on this topic. Knight *et al.,* (2017) and Jorgenson *et al.,* (2017) have found a positive relationship between income inequality and ecological footprint for developed countries. Grunewald *et al.,* (2017) explored a "trade-off" relationship between income inequality and ecological footprint in a sample of developed and developing economies. Some literature focused on individual countries. Baloch *et al.,*(2018) for Pakistan got a positive relationship, Demir *et al.,*(2019) focused on Turkey, and Bhattacharya (2019) for India; both studies explored the negative relationship.

This study focuses on the comparative analysis of income inequality and environmental sustainability across developed and developing countries. Comparative analysis of developed and developing countries will give us a unique lens to understand the relevance of different factors on environmental degradation in different income contexts. Developed economies often follow a strong regulatory framework and investment in green technology, but on the other hand, developing economies often face growth imperatives, low fiscal capacity, weak institutional framework for environmental regulation.

In the existing literature, there is a popular hypothesis, EKC, which shows the relationship between GDP per capita and environmental degradation, but the relationship between income inequality and environmental degradation is a very small amount of literature; some have reported positive, some have reported negative, and some have reported mixed results. So, our inspiration is to do an investigation on the environmental degradation (measured by the ecological footprint) and unequal income distribution (measured by the Gini inequality measure) in the developed and developing economic contexts. The findings are expected to contribute to the broader debate on achieving inclusive and sustainable development, as developed in the United Nations Sustainable Development Goals (SDGs 10 and 13), where reducing inequality and combating climate change are inherently interconnected.

2. LITERATURE REVIEW

Below, we have reviewed some literature related to this topic:

The study delves into the nexus between income inequality and environmental degradation, examining EFP. Various authors have contributed to this field, and their studies have yielded different findings. Grunewald *et al.,*(2017) got an "inverse" relationship between income inequality and ecological footprint in a sample of developed and developing countries. Zhang and Zhao (2014) found mixed results in China, while Jorgenson *et al.,*(2017) found a positive relationship between income inequality and ecological footprint in the United States. Knight *et al.,*(2017) analysed developed economies and found a positive relationship between income inequality and ecological footprint, while Ota (2017) observed mixed results in Asian developing economies. Baloch *et al.,*(2020) studied Pakistan using ARDL and found a positive relationship. Masud *et al.,*(2020) examined Vietnam, Thailand, Malaysia, the Philippines, and Indonesia, obtaining mixed results. Demir *et al.,*(2019) focused on Turkey and found a negative relationship between income inequality and ecological footprint. Bhattacharya (2019) explored Indian data and found a negative relationship. Khan, Yanhong. *et al.,*(2021) examine 18 Asian developing countries from 2006 to 2017, and want to show the nexus between income inequality, poverty, and ecological footprint. For analysis of this relationship, Driscoll-Kraay (D–K) standard error regression, for the detection of heteroscedasticity, serial correlation, and cross-sectional dependence. They have used the Ecological footprint as a dependent variable, the poverty headcount ratio, and the Gini coefficient for income inequality, GDP per capita, FDI, population growth, inflation, access to electricity, forest area, and manufacturing share of GDP. Poverty and income inequality are dangerous for the ecological footprint, and the EKC hypothesis does hold for selected countries. Inflation and Access to Electricity are negatively and significantly related; manufacturing value added is negatively but insignificantly related. FDI, forest area, and population growth are positively correlated. Ansari, Ahmad, *et al.,*(2020) investigate their research on Gulf Cooperation countries (GCC)because these countries are highly energy abundant and use countries, taking long time periods from 1991 to 2017, and want to test EKC hypothesis holds for GCC or not. For this analysis, they have used ecological footprint as a proxy for environmental degradation, and GDP per capita, globalization, and energy consumption are used as independent variables. CADF, CIPS. Westerlund test, FMOLS (Fully Modifieds), and DOLS (Dynamic OLS); these Econometrics techniques are used for analysis. Energy consumption and globalization are positively related to ecological footprint, and the EKC does not hold for GCC countries. Khan, Yanhong (2021), the research is based on the relationship between income inequality and environmental degradation (in terms of ecological footprint and CO_2 emission) for the years 2006 to2021 of 18 Asian developing economies by using Driscoll & Kraay's standard error estimator. Dependent variables are used for EF and CO_2 emission, and income inequality (Gini coefficient), FDI, Population growth, GDP per capita, and Electricity access are used as independent variables. They have found that there is a bidirectional causality between income inequality, ecological footprint, and CO_2 emission. FDI, access to electricity, and population growth decrease income inequality but increase environmental degradation; the EKC hypothesis no longer holds. Dorn, Maxand & Kneib's (2021) research is based on the relationship between carbon emissions and income inequality, focused on the non-linearity and bidirectional and country-specific differences. The theoretical logic behind the different relation between income inequality and ecological footprint is that for a positive relation status of lobbying consumption, a negative relation occurs if carbon-intensive goods consumption is less among the poor people. Methodology is used in bivariate distributional copula regression and panel data regression for 154 countries from 1960 to 2019.They divided all countries into three different income groups: High-income countries, Middle-income countries, and Low-income countries. According to Çatık *et al.,*(2024), the scope of research is for 49countries from 1995 to 2018, and aims to show the impact of globalization, energy consumption (renewable and non-renewable energy consumption), and income inequality on ecological footprint. The innovativeness of this article is that an innovative methodology has been used in this article; they have used the second generation Panel data regression model (like Common Correlated Effects (CCE) estimator, dynamic common correlated effects, factor-augmented model, and cross-sectionally augmented ARDL, Panel Unit Root & Cointegration tests allowing CSD, CIPS, and Westerlund) and Panel Threshold Error Correction Models (PTECM), The Panel threshold model identifies the non-linearity of different independent variables ‘effect, for getting better results of the threshold model author separated two growth regimes: upper and lower growth regime. They have found that income inequality and non-renewable energy significantly increase the ecological footprint, but renewable energy significantly decreases the ecological footprint, and for both, the EKC hypothesis does not hold (positively related). Wang, Yang. *et al.,*(2024) studied 62 countries from 2012 to 2020, and corruption is often linked with income inequality and its impact on carbon emissions. They have used a Threshold panel regression model. They have found that corruption increases carbon emissions driven by income inequality. P Das, S Bisai, and S Ghosh (2022) explore the impact of past pandemics on the distribution of income across income groups (high income group, upper -middle income group, lower-middle income group, and lower income group), covering the study periods from 1995 to 2017 for the 70 countries. They have used a panel data regression model (GLS method) for the study. They have found that the past pandemic has had a negative impact on upper middle-income country, a positive impact on high income country, and on all 70 countries. MA Baloch, SUD Khan, ULUCAK, A Ahmad (2020) examine the effect on CO2 emission by the cause of income inequality, per capita income, and poverty for the 40 Sub-Saharan African countries over the period 2010 - 2016. They have used Driscoll Kray regression estimation technique, and they have found that income inequality and poverty increase the co2 emission in the Sub-Saharan countries. G Wan, C Wang, J Wang, X Zhang (2022), they work on 217 countries from 1960 to the present, the instrumental variable approach shows that there is a trade-off relationship between income inequality and CO2 emission for the selected countries. Hayat Khan, Liu Weil, Itbar Khan, and Lei Han (2021) interpret how income inequality and institutional quality affect the CO2 emissions for the 180 sample countries for the years 2002 to 2019. The study used OLS, Fixed Effects, and System Generalized Method of Movement and got the result that income inequality, institutional quality, financial development, and economic growth have a direct positive relation with carbon emission, but carbon emission is reduced by the increase of trade openness and renewable energy consumption. Sohail Abbas, Shazia kousar and Amber Pervaiz (2021) studied two dimensions: the effect of traditional energy use, ecological footprint, urbanization, renewable energy, and transportation on CO2 emission in Pakistan, which is one dimension, and interpreted the correlation between temperature and CO2 emission over Pakistan. They have found no short-run significant relationship between CO2 emission and traditional energy, renewable energy, and ecological footprint, but have a long-run positive relationship with the traditional energy and ecological footprint, and a negative relationship with the renewable energy use. And they also found that CO2 emissions, urbanization, and transportation increase the average temperature significantly in the short run and in the long run in Pakistan. Wajahat Ali, Azrai Abdullah, and Muhammad Azam (2017) investigated the EKC hypothesis for Malaysia for a long period of time. ARDL and causality tests are used for testing the long-run causality, but for the robustness check Dynamic Ordinary Least Squares (DOLS) method is used. According to the causality test, there is no bidirectional causality in the short run among the variables, but in the long run, bidirectional causality between energy consumption and CO2 emission, and unidirectional causality among others variables with CO2 emission, the EKC hypothesis is valid for Malaysia for the corresponding time periods. Salim Khan and Wang Yahong (2021) work on the symmetric and asymmetric impact of poverty, income inequality, along with population, economic growth, on carbon emission.

3. THEORETICAL BACKGROUND

The Ecological Footprint measures the total human demand on biological productive land and water required to meet the human demand and absorb waste. It is the composite indicator to measure the pressure on the environment (Wackernagel & Rees, 1996). A high ecological footprint means a high level of environmental degradation and more pressure on the environment. Income Inequality is the unequal distribution of income among individuals and households within a society. Several methods are available for measuring income inequality, such as the Gini coefficient, income shares, or the Theil index. There is a different theoretical background that shows how income inequality relates to the ecological footprint, the Consumption-Inequality hypothesis: Rich people always consume more in an unsustainable way, but poor people's consumption is less, and the consumption pattern is unsustainable, and middle-income people always emulate the rich people's unsustainable lifestyle. Relative income hypothesis: Individuals emulate consumption patterns of higher-income groups (“keeping up with the rich”), which escalates ecological damage. Therefore, an unequal society will lead to a larger ecological footprint. But this type of positive relationship does not always hold; if rich people follow a sustainable lifestyle and consumption, and middle-income and poor people emulate the rich people's consumption pattern, then an unequal society will lead to less ecological footprint consumption. In that case ecological footprint will be negatively correlated with income inequality, Dorn, Maxand & Kneib (2021), because of lobbying consumption patterns, a positive relation happens, a negative relation will happen if carbon-intensive goods consumption is less among the poor people. From a political economy perspective, income inequality leads to more environmental degradation, and rich people always focus on more economic growth by using their political power, irrespective of concern with environmental sustainability, but the poor fall behind in political awareness and power; therefore, they are not able to demand sustainable environmental goods.

4. DATABASE AND METHODOLOGY

The current study utilizes cross-country panel data from 52 countries spanning the period from 1995 to 2018. These countries have been categorized into two groups: developed and developing countries. The key variables under investigation are environmental sustainability, represented by Ecological Footprint (EF)(high ecological footprint means less environmental sustainability and vice versa), and unequal income distribution, represented by GINI, Additionally, control variables have been considered: GDP per capita (constant 2017 international $) and FDI net inflows (% of GDP), Urban population(URB) (% of the total population), Population growth(POP) (annual %), Manufacturing, value added(MANF) (% of GDP), Inflation, consumer prices(CPI) (annual %), Forest area(FRST) (sq. km). The data on income inequality is sourced from the "Standardized World Income Inequality Database," while the EFP data is gathered from the "Global Footprint Network (GFN)." GDP per capita, and FDI net inflow, Urban population (% of the total population), Population growth (annual %), Manufacturing, value added (% of GDP), Inflation, consumer prices (annual %), Forest area (sq. km) are collected from "World Development Indicators". The unit of measurement for Ecological Footprint is global hectares (Gha), cropland, grazing land, forest land, fishing ground, and built-up land. Forest land serves two distinct and competing uses: Forest products and CO2 sequestration. It should be noted that the data on income inequality and Ecological Footprint are available for limited years and countries. While income inequality data is available for 69 countries from 1995 to 2020, EFP data is only available for 52 countries from 1995 to 2018. Thus, the analysis is focused on the 52 countries that have data for both income inequality and EFP during the period from 1995 to 2018. In our research, we employ static panel data regression models to investigate the relationship between ecological footprint and income inequality over time. We estimate these models through a Pooled regression model, fixed and random effects model, using ordinary least squares (OLS) estimation, generalized least squares (GLS) estimation, and least squares dummy variables (LSDV) estimation for the parameters of the fixed and random effect models, respectively.

To ascertain the importance of decomposing the constant and error term, we apply the Wald test, the Breusch and Pagan Lagrange Multiplier test, and the Restricted F-test. Additionally, we employ the Hausman specification test to determine the best-fit model.

The panel data regression model is represented as follows:

$$\mathbf{EF_{it} = \alpha + \beta_{it}X_{it} + t_t + \delta_i + \varepsilon_{it}}$$

Where EF denotes the ecological footprint per capita, X represents the vector of independent variables, and the subscripts i = 1, N denote the country, while t = 1, T denotes the time. The vector X comprises macroeconomic variables, including the Gini coefficient of inequality (net of taxes), FDI (Net inflows (% of GDP)), and GDP per capita (constant 2017international $), Urban population(URB) (% of total population), Population growth(POP) (annual %), Manufacturing, value added(MANF) (% of GDP), Inflation, consumer prices(CPI) (annual %), Forest area(FRST) (sq. km). δ_i represents the unobserved country-level fixed effect, t_t represents the time-fixed effect, and ε represents the error term.

5. RESULTS

5.1. Comparative Analysis of Ecological Footprint between Developed and Developing Countries

In Table 1 below, we have seen that the mean value of the Ecological Footprint in Developed Countries is 3.29, which is greater than the mean value of the Ecological Footprint in developing countries, which is 1.14. Per head Ecological Resource demand on the Environment is higher in a developed country than in a developing country. A higher per-head ecological footprint means more pressure on the environment. Because of the high level of industrialization in developed countries, they have degraded the environment more than developing countries. The variance of the Ecological Footprint for developed countries is 1.011, and the variance of the Ecological Footprint of developing countries is 0.386; the calculated value of the F statistic is 2.618, and the corresponding probability is less than one percentage level. Therefore, the null hypothesis of equal variance between developed and developing countries is rejected here. There is a huge variation in Ecological Footprint across developed and developing countries, but the variation in Ecological Footprint is higher in developed countries than in developing countries.

Table 1: F-Test Two-Sample for Variances

Statistic	*EF(Developed)*	*EF(Developing)*
Mean	3.293339	1.144484
Variance	1.011061	0.386124
Observations	576	672
df	575	671
F	2.61849	0
P(F<=f) one-tail	6.22E-33	0
F Critical one-tailed	1.140998	0

Source: Author's own calculation

5.2. Comparative Analysis of Gini Inequality between Developed and Developing Countries

In Table 2 below, we have seen that the mean value of the Gini Inequality in Developed Countries is 34.109, which is less than the mean value of the Gini Inequality in developing countries, which is 50.949. Asymmetric resource distribution in developing countries is higher than in developed countries. The resource concentration in someone's hands is higher in developing countries, but the resource concentration in someone's hands is lower in developed countries. Because in developing countries, government systems are very weak and the corruption rate is very high, which leads to more unequal resource distribution in developing countries. The variance of the Gini Inequality for developed countries is 36.240, and the variance of the Gini Inequality of developing countries is 46.950; the calculated value of the F statistic is 0.771, and the corresponding probability is less than one percentage level. Therefore, the null hypothesis of equal variance between developed and developing countries is rejected here. There is a huge variation in Gini Inequality across developed and developing countries.

Table 2: F-Test Two-Sample for Variance

Statistic	*gini(Developed)*	*gini(Developing)*
Mean	34.10945	50.94966
Variance	36.24044	46.95085
Observations	576	672
df	575	671
F	0.77188	0
P(F<=f) one-tail	0.000679	0
F Critical one-tailed	0.875741	0

Source: Author's own calculation

Gini Inequality is linearly negatively associated with the Ecological Footprint in Developed country. That indicates that one unit increase in income inequality results in a 28.53 percent reduction in environmental degradation in developed countries because in Developed country, government policies for environmental regulation are very strict. Therefore, although income inequality is high, people in developed country are following the sustainable consumption and production pattern. But in the developing country, Gini Inequality is linearly positively correlated with Ecological Footprint. For a one-unit increase in Gini Inequality, the Ecological Footprint will increase by 1.86 percentage points. Because in a developing country, the government policy on environmental regulation is very poor. Therefore, people in developing countries have adopted less environmentally friendly consumption and production patterns.

Table 3: Correlation between EF and Gini (Developed)

Variables	*EF(Developed)*	*Gini (Developed)*
EF(Developed)	1	-0.28539
Gini (Developed)	-0.28539	1

Source: Author's own calculation

Table 4: Correlation between EF and Gini (Developing)

Variables	*EF(Developing)*	*Gini (Developing)*
EF(Developing)	1	0.01866
Gini (Developing)	0.01866	1

Source: Author's own calculation

5.3. Econometric Results

In this section, we will examine the effect of unequal income distribution (measured by the Gini Inequality) on Environmental Sustainability (measured by the Ecological Footprint) in a comparative analysis between developed and developing countries. Therefore, we have used two models, models1 shows the regression analysis of the developed country, and model 2 shows the regression analysis of the developing country.

Table 5 presents the estimated results of Model 1. We have performed an LM test to show which model is the best model between the Random Effect and the Pooled regression model. We find that the LM test is significant; therefore, we have chosen the Random Effect Model over the Pooled Regression Model. We have also performed the restricted F test to show which model is the best model between the Fixed Effect and Pooled regression model, and we find that the Restricted F test is significant, so we have chosen the Fixed Effect Model over the Pooled Regression model, leading us to further perform the Hausman test for the selection between the Random Effect Model (REM) and Fixed Effect Model (FEM). We find the Hausman test statistic is insignificant. Thus, we consider the REM for interpretation.

We find Gini Inequality is inversely related to the Ecological Footprint, significant at less than a 5 percent level. With a one-unit increase in income inequality (proxy for unequal income distribution), the Ecological Footprint (proxy for environmental sustainability) decreased by 0.0163unit. People in developed country follows the sustainable consumption and production pattern, although income distribution is uneven. In the short period, GDP per capita significantly increases environmental degradation, but in the longer period, it significantly decreases environmental degradation. Therefore, the Environmental Kuznets Curve (EKC) hypothesis holds for developed countries, and environmental degradation is converging in the long run. This is because initially, when GDP per capita increases peoples demand more, and more resource utilization is needed, which will increase the degradation of the environment, but after a certain level of national income, environmental degradation is reduced because demand more sustainable goods, therefore government will increase the expenditure on green technology.

FDI net inflows, forest area (square kilometers), and population growth are positively correlated with the Ecological Footprint. one unit increase of FDI the Ecological Footprint will increased by the 0.0045 unit and one unit increase of forest area (square kilometer) the Ecological Footprint will increased by the 0.000000176 unit (very small amount) and one unit increase of population growth the Ecological Footprint will increased by the 0.121 unit. More FDI means more investment and more resource demand, which will increase environmental degradation in developed countries. More population growth will lead to more environmental degradation in developed countries, because more population growth means more resource utilization and more pressure on the environment. Inflation and Manufacturing Value Added are significantly and inversely correlated with the Ecological Footprint. A one-unit increase in inflation, the Ecological Footprint will decrease by 0.031 unit and one unit increase in manufacturing value added, the Ecological Footprint will decrease by 0.01 units.

The no of observations for the estimation of the developed country is 576. Overall, the variability of all explanatory variables can explain 58.07 percent of the variability of the dependent variable (Ecological Footprint). The within-group variability (variability across all time periods) of all explanatory variables can explain 34.39 percent of the within-group variability of the dependent variable (Ecological Footprint). The between-group variability (variability across countries) of all explanatory variables can explain 66.62 percent of the between-group variability of the dependent variable (Ecological Footprint).

Table 5: Estimated Result of Model I (Developed Country)

Random Effect Model			Fixed Effect Model	
Variables	**Coefficient**	**P-value**	**Coefficient**	**P-value**
gini	-0.0163588	0.024	-0.0173305	0.023
gdp	0.0000553	0	0.0000534	0
gdp2	-3.63E-10	0	-3.49E-10	0
FDI	0.0045659	0.045	0.004335	0.055
Forest Area (sq km)	0.000000176	0	0.000000148	0
Inflation (annual %)	-0.0319776	0	-0.0323298	0
Manufacturing (% GDP)	-0.010148	0.098	-0.0068583	0.275
Population Growth (annual %)	0.1212636	0	0.1240033	0
Urban Population (%)	0.0046451	0.12	0.0032829	0.281
Constant	1.903277	0	2.058915	0
No of Observations	576		576	
Number of Groups	24		24	

Overall R-Square	0.5807		0.5452	
Within R-Square	0.3439		0.3451	
Between R-Square	0.6662		0.6145	
rho	0.64625257		0.78796581	
Test	**Statistic**	**P-value**	0	0
Breusch-Pagan LM Test (RE)	1384.66	0	0	0
Hausman Test	-10.63	Invalid (chi2 < 0)	0	0
F test that all u_i=0 (FE)	45.38	0	0	0

Source: Author's own calculation

Table 6 presents the estimated results of Model 2. We have performed an LM test to show which model is the best model between the Random Effect and the Pooled regression model. We find that the LM test is significant; therefore, we have chosen the Random Effect Model over the Pooled Regression Model. We have also performed the restricted F test to show which model is the best model between the Fixed Effect and Pooled regression model, and we find that the Restricted F test is significant, so we have chosen the Fixed Effect Model over the Pooled Regression model, leading us to further perform the Hausman test for the selection between the Random Effect Model (REM) and Fixed Effect Model (FEM). We find the Hausman test statistic is insignificant. Thus, we consider the REM for interpretation.

We find Gini Inequality is positively related to the Ecological Footprint, significant at less than a 10 percent level. With a one-unit increase in income inequality (proxy for unequal income distribution), the Ecological Footprint (proxy for environmental sustainability) increased by 0.003828unit. People in a developing country follow the unsustainable consumption and production pattern; therefore, uneven income distribution is leading to more environmental degradation. In the short period, GDP per capita significantly increases environmental degradation, but in the longer period, it significantly decreases environmental degradation. Therefore, the Environmental Kuznets Curve (EKC) hypothesis also holds for developing countries, and environmental degradation is converging in the long run. This is because initially, when GDP per capita increases peoples demand more, and more resource utilization is needed, which will increase the degradation of the environment, but after a certain level of national income, environmental degradation is reduced because demand more sustainable goods, therefore government will increase the expenditure on green technology.

FDI net inflows are negative but insignificant relationship with the Ecological Footprint, forest area (square kilometers), and population growth are significantly positively correlated with the Ecological Footprint. one unit increase of forest area (square kilometer) the Ecological Footprint will increased by the less than one unit (very small amount) and one unit increase of population growth the Ecological Footprint will increased by the 0.024004 unit. More population growth will lead to more environmental degradation in developing countries, because more population growth means more resource utilization and more pressure on the environment. Inflation and Manufacturing Value Added are insignificantly and positively correlated with the Ecological Footprint.

The no of observations for the estimation of the developing country is 672. Overall, the variability of all explanatory variables can explain 50.65 percent of the variability of the dependent variable (Ecological Footprint). The within-group variability (variability across all time periods) of all explanatory variables can explain 62.17 percent of the within-group variability of the dependent variable (Ecological Footprint). The between-group variability (variability across countries) of all explanatory variables can explain 49.48 percent of the between-group variability of the dependent variable (Ecological Footprint).

Table 6: Estimated Result of Model II (Developing Country)

Random Effect Model			**Fixed Effect Model**	
Variables	**Coefficient**	**P-value**	**Coefficient**	**P-value**
gini	0.003828	0.076	0.003671	0.095
gdp	0.00013	0	0.00013	0
gdp2	-2E-09	0	-2E-09	0
FDI	-0.00171	0.337	-0.00166	0.355
Forest Area (sq km)	4.77E-08	0.047	4.82E-08	0.052
Inflation (annual %)	0.000242	0.673	0.000244	0.672
Manufacturing (% GDP)	3.88E-06	0.998	5.09E-05	0.976
Population Growth (annual %)	0.024004	0.028	0.023987	0.03
Urban Population (%)	0.000584	0.468	0.000621	0.446
Constant	-0.01197	0.938	-0.00755	0.952

Number of Observations	672		672	
Number of Groups	28		28	
R-sq (within)	0.6217		0.6218	
R-sq (between)	0.4948		0.4944	
R-sq (overall)	0.5065		0.5062	
rho	0.94382893		0.92530342	
Test	**Statistic**	**P-value**	0	0
Breusch-Pagan LM Test (RE)	6315.42	0	0	0
Hausman Test chi2(7)	0.42	0.9997	0	0
F test that all u_i=0 (FE)	281.9	0	0	0

Source: Author's own calculation

6. CONCLUSION

The present research study has shed light on the intricate connection between environmental quality and income inequality, emphasizing the significance of considering both factors in the pursuit of sustainability. Development Goals (SDGs). By meticulously analysing data from 52 economies encompassing developed and developing nations spanning the years 1995 to 2018, the study has explored the relationship between environmental degradation and unequal income distribution. To ensure comprehensiveness, several control group variables, including GDP per capita and FDI net inflows (% of GDP), Forest area (FRST) (sq. km), Manufacturing value added (MANF) (% of GDP), Population growth (POP) (annual%), Urban population (URB) (% of total population) were incorporated in the analysis.

From our analysis, we have found that in developed country income inequality (Gini) is negatively correlated with the ecological footprint, because in develop country government has taken strong environmental regulation on the other hand peoples in developed countries always follow a sustainable consumption pattern, rich peoples in developed country always take a sustainable consumption pattern and middle-income peoples emulate rich people's consumption habit. But in the developing country, Gini inequality is positively correlated with the ecological footprint because in developing countries, government policy for the environment is very weak, and rich people in developing countries follow the energy incentive consumption pattern, and poor people are more dependent on natural resources.

GDP per capita initially positively and later negatively correlated with the ecological footprint for both developed and developing economies. Because initially, when GDP per capita increases, the purchasing power of the people will also increase, so people will demand more natural resources, but later, when GDP per capita increases again, then environmental degradation decreases, because at that time the government spends more on green energy and green technology, and peoples follows less energy-intensive consumption pattern. Therefore, we can say that the Environmental Kuznets Curve hypothesis (EKC) holds for both developed and developing economies.

Forest area, Urban Population, and Population Growth are positively correlated with the ecological footprint for both developed and developing economies. More unsustainable urbanization means more pollution on environment, and more population growth means more people rely on the natural resources, so ecological demand will increase. Manufacturing value added and inflation are negatively related, and FDI is positively related to the ecological footprint in developed countries. On the other hand, manufacturing value added and inflation are positively correlated, and FDI is negatively correlated with the ecological footprint in the developing country.

The variability of environmental degradation (measured by the ecological footprint) in developed countries is greater than the variability of the ecological footprint in developing countries, but on the other hand, the variability of the unequal income distribution (measured by the Gini) in developing countries is higher than the variability of the Gini in developed countries.

The government of a developing country should follow some policy on the reduction of income inequality and take stick environmental policy that will reduce environmental degradation. A developed country government should follow a policy that will reduce income inequality and environmental degradation. And the government should also take initiatives to reduce population growth, %of the urban population, and increase the forest areas, which will possibly lead to a subsequent decrease in ecological footprint. By adopting such measures, the pursuit of Sustainable Development Goals (SDGs) can be effectively advanced.

REFERENCES

1. Abbas, S., Kousar, S., & Pervaiz, A. (2021). Effects of energy consumption and ecological footprint on CO2 emissions: empirical evidence from Pakistan. Environment, Development and Sustainability, 23(9), 13381-13395.
2. Ali, W., Abdullah, A., & Azam, M. (2017). Re-visiting the environmental Kuznets curve hypothesis for Malaysia: Fresh evidence from the ARDL

bounds testing approach. Renewable and Sustainable Energy Reviews, 77, 990-1000.
3. Ansari, M. A., Ahmad, M. R., Siddique, S., & Mansoor, K. (2020). An environmental Kuznets curve for ecological footprint: Evidence from GCC countries. *Carbon Management*, *11*(4), 355-368.
4. Baloch, M. A., Khan, S. U. D., Ulucak, Z. Ş., & Ahmad, A. (2020). Analyzing the relationship between poverty, income inequality, and CO2 emissions in Sub-Saharan African countries. Science of the Total Environment, 740, 139867.
5. Bhattacharya, H. (2020). Environmental and socio-economic sustainability in India: evidence from the CO2 emission and economic inequality relationship. Journal of Environmental Economics and Policy, 9(1), 57-76.
6. Çatık, A. N., Bucak, Ç., Ballı, E., Manga, M., &Destek, M. A. (2024). How do energy consumption, globalization, and income inequality affect environmental quality across growth regimes? *Environmental Science and Pollution Research*, *31*(7), 10976-10993.
7. Das, Pinaki, Bisai, S., & Ghosh, S. (2022). Impact of pandemics on income inequality: lessons from the past. International Review of Applied Economics, 35(2), 1-19.
8. Demir, C., Cergibozan, R., & Gök, A. (2019). Income inequality and CO2 emissions: Empirical evidence from Turkey. Energy & Environment, 30(3), 444-461.
9. Dorn, F., Maxand, S., & Kneib, T. (2021). *The dependence between income inequality and carbon emissions: A distributional copula analysis* (No. 413). Cege Discussion Papers.
10. Grunewald, N., Klasen, S., Martínez-Zarzoso, I., & Muris, C. (2017). The trade-off between income inequality and carbon dioxide emissions. Ecological Economics, 142, 249-256.
11. Hieu, V. M. (2022). Influence of green investment, environmental tax, and sustainable environment: Evidence from ASEAN countries. International Journal of Energy Economics and Policy, 12(3), 227-235.
12. Jorgenson, A., Schor, J., & Huang, X. (2017). Income inequality and carbon emissions in the United States: a state-level analysis, 1997–2012. Ecological Economics, 134, 40-48.
13. Kalina, M. (2021). As South Africa's cities burn, we can clean up, but we cannot sweep away inequality. Local Environment, 26(10), 1186-1191.
14. Khan, H., Weili, L., Khan, I., & Han, L. (2022). The effect of income inequality and energy consumption on environmental degradation: the role of institutions and financial development in 180 countries of the world. Environmental Science and Pollution Research, 29(14), 20632-20649.
15. Khan, S., &Yahong, W. (2021). Income inequality, ecological footprint, and carbon dioxide emissions in Asian developing economies: what effects what and how? Environmental Science and Pollution Research, 29(17), 24660-24671.
16. Khan, S., &Yahong, W. (2021). Symmetric and asymmetric impact of poverty, income inequality, and population on carbon emission in Pakistan: new evidence from ARDL and NARDL cointegration. Frontiers in Environmental Science, 9, 666362.
17. Khan, S., Yahong, W., & Zeeshan, A. (2021). Impact of poverty and income inequality on the ecological footprint in Asian developing economies: Assessment of Sustainable Development Goals. Energy Reports, 8, 670-679.
18. Knight, K. W., Schor, J. B., & Jorgenson, A. K. (2017). Wealth inequality and carbon emissions in high-income countries. Social Currents, 4(5), 403-412.
19. Masud, M. M., Kari, F., Banna, H., & Saifullah, M. K. (2020). Does income inequality affect environmental sustainability? Evidence from the ASEAN-5. In *Climate change mitigation and sustainable development* (pp. 27-42). Routledge.
20. Ota, T. (2017). Economic growth, income inequality, and environment: assessing the applicability of the Kuznets hypotheses to Asia. Palgrave Communications, 3(1), 1-23.
21. Rees, W., & Wackernagel, M. (2008). Urban ecological footprints: why cities cannot be sustainable—and why they are a key to sustainability. In *Urban ecology: an international perspective on the interaction between humans and nature* (pp. 537-555). Boston, MA: Springer US.