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Three Phases of Human Development Index Towards Global Common Stewardship Based on Environmental Kuznets Curve

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ABSTRACT

The purpose of this study is to examine the effect of economic development (represented as the human development index) on environmental degradation (represented as global commons stewardship) with income level phase separation based on the Environmental Kuznets Curve to find out whether there is environmental policy during economic development. Environmental degradation is one of the urgent problems that must be addressed before it is too late. Every country should have a more environmentally oriented outlook apart from economic development. The research model test was carried out using multiple linear regression methods in STATA. The results of the study show that no country has succeeded in having a good environmental level with high economic development. Environment policy needs to be implemented in every country to maintain the ecosystems on earth during economic development. So far, it is evident that each country has paid little attention to its surrounding environment and has only focused on economic development.

Keywords: *human development index, global common stewardship, environmental kuznets curve, sustainability, environmental degradation*

ABSTRAK

Tujuan dari penelitian ini adalah untuk menguji pengaruh pembangunan ekonomi (direpresentasikan sebagai indeks pembangunan manusia) terhadap degradasi lingkungan (direpresentasikan sebagai *global commons stewardship*) dengan pemisahan fase tingkat pendapatan berdasarkan Environment Kuznets Curve untuk mengetahui apakah ada kebijakan lingkungan selama pembangunan ekonomi. Degradasi lingkungan merupakan salah satu masalah mendesak yang harus segera diatasi sebelum terlambat. Setiap negara patut memiliki wawasan yang lebih berorientasi juga terhadap lingkungan selain dari perkembangan ekonomi. Uji model penelitian dilakukan dengan menggunakan metode regresi linier berganda melalui STATA. Hasil penelitian menunjukkan bahwa tidak ada negara yang berhasil memiliki tingkat lingkungan yang baik dengan pembangunan ekonomi yang tinggi. Strategi mengenai pengembangan lingkungan perlu di implementasikan pada setiap negara untuk tetap menjaga ekosistem yang ada di bumi selama perkembangan ekonomi. Selama ini terbukti bahwa setiap negara kurang memperhatikan lingkungan sekitarnya dan hanya berfokus pada perkembangan ekonomi.

Kata kunci: *human development index, global common stewardship, environmental kuznets curve,* keberlanjutan, degradasi

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INTRODUCTION

It is undeniable that the environment is degrading rapidly, which results in an increasing threat to human health and well-being. This is indicated by unsustainable resource use, destruction of nature, and pollution which cause climate change and threaten the Earth's system (Riyono & Widianingsih, 2023). It has been revealed through various studies that numerous vital biophysical systems and planetary boundaries have already been breached, with several others still at risk (Asada et al., 2020; Giuliani et al., 2020; Liu et al., 2019; Pacheco et al., 2018; Schultz, 2020; Shaddick et al., 2020). The global commons comprise the climate system, Earth's biosphere, ozone layer, oceans, ice sheets, and glaciers (Robinson, 2021). It is crucial to prioritize environmental conservation to achieve sustainability and maintain the balance of the global commons (Ishii et al., 2024). Major and rapid transformations are required to reverse negative trends in energy, production, and consumption systems.

Global Commons Stewardship (GCS) is a derivative of sustainability indicators that are oriented toward how countries affect the global commons both within their own domestic and transnational spillovers (SDSN, 2021). The Global Commons Score (GCS) Index evaluates environmental factors that reflect each country's challenges and impacts in the global commons, which include the oceans, ozone layer, atmosphere, and biodiversity. As shown in Figure 1, six sub-pillars categorize the impacts on the environment, which are aerosol and greenhouse gas (GHG) emissions, loss of biodiversity in terrestrial and marine biomes, and disruptions to water and nutrient cycles (Ishii et al., 2024). This highlights the importance of having a better understanding of the environment's state and urgency in taking necessary actions.

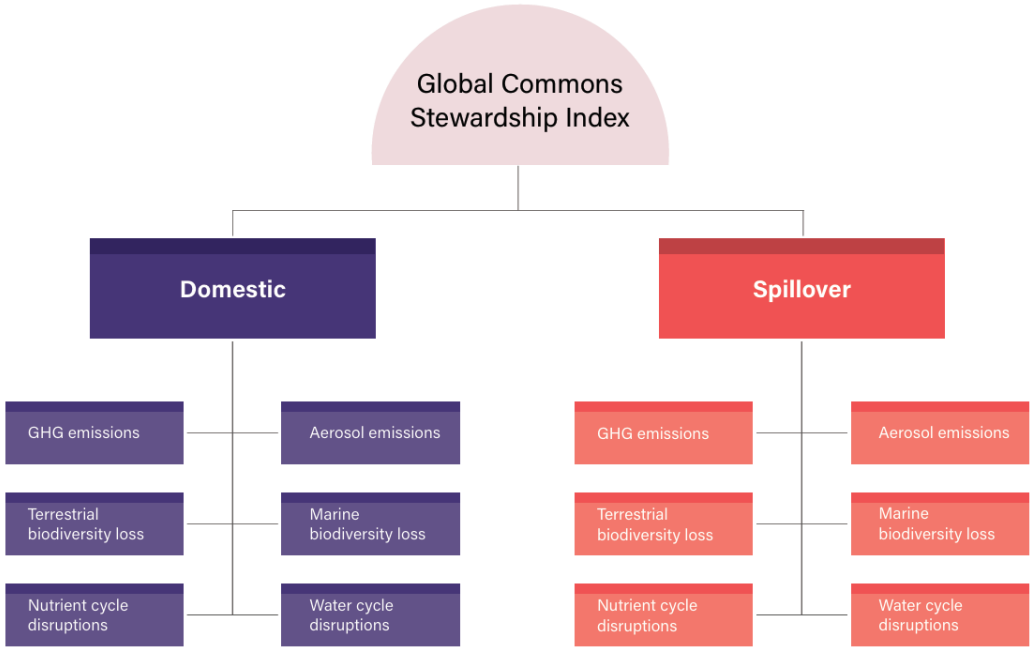

Figure 1. Global Commons Stewardship Index
Source. Sustainable Development Solutions Network (2024)

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Previous studies indicate that economic growth may result in environmental degradation and a weak ecological profile (Ekonomou & Halkos, 2023). This is due to the rapid growth of economic activity, which leads to increased energy consumption, global emissions, and the exploitation of natural resources, resulting in negative environmental consequences (Md Moyen Uddin et al., 2021). However, as economic development progresses, the increase in finances enables them to invest in newer technologies and sustainable resources that reduce the adverse effects on the environment (Prasad, 2023). This explains the inverted U-shaped relationship hypothesis between economic growth and environmental degradation, referred to as the Environmental Kuznets Curve (EKC) hypothesis as shown in Figure 2. The U-shaped EKC shows that in the early phase of economic development, environmental degradation increases due to consumerism of natural resources usage (Leal & Marques, 2022). However, at a certain level of gross domestic product per capita, it will tend to decrease due to the development of public awareness and concern about environmental degradation (Datta & De, 2021).

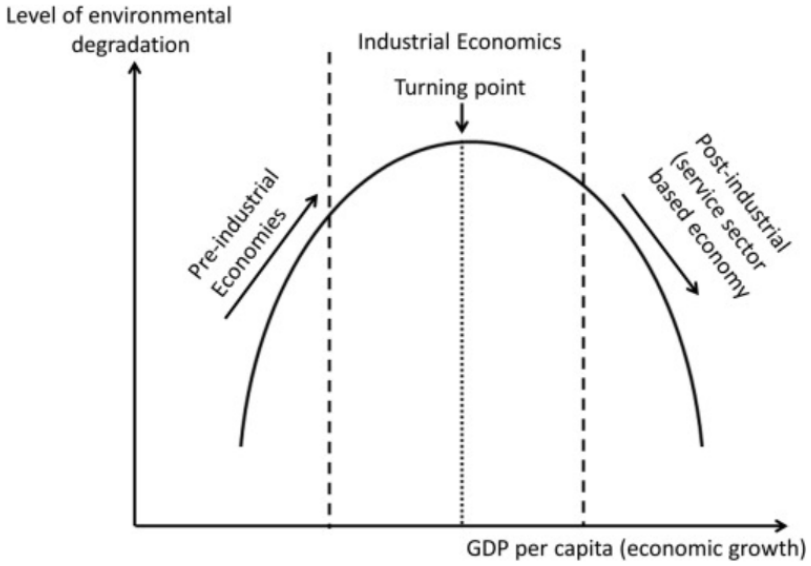

Figure 2. Environmental Kuznets Curve
Source. Prasad (2023)

The Environmental Kuznets Curve hypothesis suggests that developing countries often prioritize economic growth over environmental concerns, while developed countries tend to focus on environmental issues at a later stage of development. This approach is commonly referred to as "Grow first and clean up later", implying that countries can still develop even with environmental problems (Blampied, 2021; Kahuthu, 2006). However, this strategy prioritizes economic growth over environmental policy, which may hinder the achievement of environmental objectives. Environmental policies can also pose a constraint to economic growth, leading to an approach that disregards the potential risks of irreversible damage to ecosystems and the high costs of cleaning up later.

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The human development index is a tool used to rank countries based on their level of human development (Dr. Pravin Ransure, 2019). It indicates whether a country is developed, developing, or underdeveloped. The human development index is an important factor in economic growth as it reflects global progress (Lind, 2019). There is a causal relationship between the human development index and economic growth, as the human development index is based on income per capita (Osiobe, 2019). Therefore, the human development index can be seen as a representation of economic growth (Ishii et al., 2024).

This study aims to investigate the effect of human development index towards global commons stewardship at each stage of economic development, separated by income level based on the Environmental Kuznets Curve. By representing the human development index as economic development, it is intended to find out whether there are differences in environmental policy decision-making between non-developed (low-income), developing (middle-income), and developing countries (high-income). The study's results offer valuable insights that should be taken into consideration in economic development strategy to enhance the pursuit of sustainability by the country.

Based on the description above, the hypothesis made is as follows:

H1 : Human development index affects global commons stewardship at the low-income country level

H2 : Human development index affects global commons stewardship at the medium-income country level

H3 : Human development index affects global commons stewardship at the high-income country level

METHOD

Sample, Variables, and Measurement

The research sample consists of 152 countries from all parts of the world. The independent and dependent variables are measured using an index obtained from the Sustainable Development Solutions Network in collaboration with the Yale Center for Environmental Law & Policy and the Center for Global Commons at the University of Tokyo in 2024.

The dependent variable is global commons stewardship, measured using six sub-pillars to categorize the impacts on the environment, which are aerosol and greenhouse gas (GHG) emissions, loss of biodiversity in terrestrial and marine biomes, and disruptions to water and nutrient cycles. The independent variable is human development index which is measured based on the country's health, education, and income per capita. The classification used is based on the separation of GDP per capita categories by the World Bank, which consists of low-income countries, lower-middle-income countries, upper-middle-income countries, and high-income countries. To align with the Environmental Kuznets Curve's three phases of economic development, the middle-income category comprises both lower-middle-

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income and upper-middle-income countries. This is because these two groups share similar characteristics and scales, and therefore, it makes sense to focus on middle-income countries (Eichengreen et al., 2018; Yang, 2019). The index of each variable is scaled from 0 to 100, which 0 representing the worst performance and 100 representing the optimal performance.

Analysis Method

The research model test was carried out using multiple linear regression methods. The analysis procedure in this study includes a classical assumptions test which consists of normality and heteroscedasticity, descriptive statistical analysis, testing the feasibility of the research model with the F test, and testing the hypothesis with the t-test using multiple linear regression.

RESULT AND DISCUSSIONS

Statistic Descriptive

As shown in Table 1, the descriptive statistics of low-income countries indicate that most of these countries have a high level of global commons stewardship, scoring 73.71 out of 100, which suggests that environmental degradation is not a major concern in these countries. Eritrea ranks first in the level of global commons stewardship with a score of 88.14. However, the human development index in low-income countries is predominantly low, with an average score of 48.25 out of 100, which poses a significant challenge to the economic development of these countries. The country with the lowest human development index is Chad, scoring 39.4, while Venezuela, with a score of 69.1, has surpassed the lower limit of middle-income countries.

Table 1. Statistic Descriptive of Low-Income Countries

Variable	Obs	Mean	Std. Dev.	Min	Max
gcs	22	73.71216	10.58048	46.24703	88.14909
hdi	22	48.25909	6.319332	39.4	69.1

Based on Table 2, the descriptive statistics on middle-income countries indicate a decline in global common stewardship from low-income countries, with an average score of 52.15 out of 100. This figure shows that environmental degradation is becoming a problem as countries enter middle-income status. Russia has the worst level of environmental degradation in middle-income countries, surpassing even some high-income countries, with a score of 28.40. Tajikistan, on the other hand, has the highest level of global common stewardship among middle-income countries. However, it can still improve its economic development by conserving the environment.

The human development index in middle-income countries has increased from low-income countries, with an average score of 68.99 out of 100. This indicates that most countries already have good human capital. Guinea managed to achieve

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rapid economic development despite having a low level of human development index, with a score of 46.5. This suggests that economic development can occur even with a low level of human development index. Bangladesh has the highest human development index score in middle-income countries, with a score of 87.5.

Table 2. Statistic Descriptive of Middle-Income Countries

Variable	Obs	Mean	Std. Dev.	Min	Max
gcs	80	52.15938	12.95709	28.40186	78.49146
hdi	80	68.99375	9.932842	46.5	87.5

Table 3 indicates that High-income countries exhibit the worst environmental degradation with an average global commons stewardship score of 22.64 out of 100. This indicates the need for high-income countries to pay more attention to the environment along with economic development. Qatar has the lowest global common stewardship score of 2.83, signifying an urgent need to address the environment in the country. Among high-income countries, Panama has the highest level of global common stewardship with a score of 46.52, highlighting the importance of maintaining and continuously improving the environment in the country.

Additionally, high-income countries have the highest level of human development index with an average score of 89.68. This indicates that countries with higher human capital better support economic development. Panama, despite having the best global commons stewardship score among high-income countries, has the lowest human development index score of 80.5. On the other hand, the country with the highest level of human development index is 96.2 but has a low global commons stewardship score of 11.17.

Table 3. Statistic Descriptive of High-Income Countries

Variable	Obs	Mean	Std. Dev.	Min	Max
gcs	50	22.6451	10.63529	2.833396	46.52514
hdi	50	89.68	4.520339	80.5	96.2

Classical Assumption Testing Results

According to the results shown in Table 4, the standard error passes the normality test as the value 0.5707 is greater than the significance level of 0.05. Moreover, Table 5 indicates that the data is free from heteroscedasticity as the value of 0.6316 is also greater than 0.05. Therefore, the model has met all the required criteria and can be used for research.

Table 4. Normality Test Result

Variable	Prob>chi2
res	0.5707

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Table 5. Heteroscedasticity Test Result

Item	Result
Prob > chi2	0.6316

Model Feasibility Test Results and Hypothesis Testing

The F test results indicate that 0.0305 is less than 0.05, which confirms the feasibility of the model. Hence, it can proceed to the hypothesis testing stage as shown in Table 6. According to the t-test results presented in Table 7, the first hypothesis that the human development index affects global commons stewardship at the low-income country level is accepted. The contribution of the human development index to global commons stewardship is 17.38%. This can be explained in the model, while the rest is attributed to other variables outside the model.

Table 6. Low-Income Countries Model Feasibility Test Result

Prob > F	Adj R-squared
0.0305	0.1738

Table 7. Low-Income Countries Hypothesis Testing Result

Variable	Coef.	t	P>|t|
hdi	-.7730506	-2.33	0.031

The results of the F-test in Table 8 show that the value of 0.0001 is less than the significance level of 0.05. This confirms that the model is feasible and can proceed to the hypothesis testing stage. Table 8 presents the t-test results, which indicate that the second hypothesis, stating that the human development index affects global commons stewardship at the middle-income country level, is accepted. The human development index contributes 16.35% to the global commons stewardship, while the rest is attributed to other variables not included in the model.

Table 8. Middle-Income Countries Model Feasibility Test Result

Prob > F	R-squared
0.0001	0.1635

Table 9. Middle-Income Countries Hypothesis Testing Result

Variable	Coef.	t	P>|t|
hdi	-.5443499	-4.06	0.000

According to the F-test results in Table 10, the value of 0.0159 is lower than the significance level of 0.05. This confirms that the model is feasible and can proceed to the hypothesis testing stage. Table 11 presents the t-test outcomes, which indicate that the third hypothesis is accepted. It states that the human development index

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affects global commons stewardship at the high-income country level. The human development index contributes 9.69% to the global commons stewardship, while the remaining percentage is attributed to other variables not included in the model.

Table 10. High-Income Countries Model Feasibility Test Result

Prob > F	R-squared
0.0159	0.0969

Table 11. High-Income Countries Hypothesis Testing Result

Variable	Coef.	t	P>|t|
hdi	-.7988543	-2.50	0.016

Discussions

The results of the hypothesis test indicate that economic development (as measured by the human development index) has a significant negative impact on the environment, regardless of whether it takes place in low-income, middle-income, or high-income countries. This suggests that countries do not change their conservation strategies after achieving economic development but continue to prioritize rapid economic growth. As a result, the Environmental Kuznets Curve is not proven in the development of countries around the world. Figure 3 shows that environmental degradation, as measured by global commons stewardship, continues to worsen as a country's economic development (represented as GDP per capita) increases with no sign of improvement.

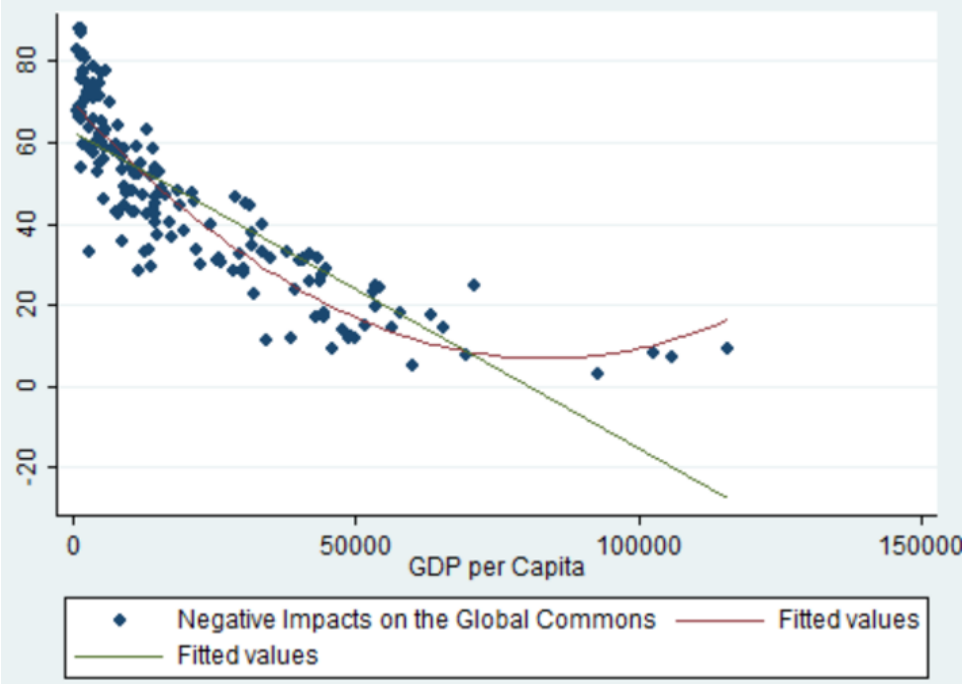

Figure 3. Economic Development and Global Commons Stewardship
Source. Processed Data (2024)

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Environmental degradation has been indicated since during the initial phases of economic development, particularly in low-income or non-developed countries. This is because countries with low income often prioritize rapid economic development over environmental initiatives to quickly develop the country. The early phase of economic development requires excessive resources, without them, development cannot take place. Therefore, all available resources in the country are drained to execute the development plan. As a result, there is an overuse of resources, which results in environmental degradation. This is what non-developing countries do to develop, regardless of the risks. This finding is consistent with the research conducted by Kahuthu (2006) regarding the "Grow first and clean up later" approach. This approach suggests that countries tend to prioritize development without considering its impact, and only address the impact in the future. (Blampied, 2021) said the same thing low-income countries tend to experience increased environmental damage due to mass revolutions at all costs to develop regardless of the risks.

During the phase of industrialization, middle-income countries witnessed a degradation in the environment due to the rise of various industries. Such countries often prioritize industry and manufacturing as their primary economic activities, which in turn, results in air pollution, deforestation, and increased global emissions. This is also reflected in the idea of "Grow first clean up later" where middle-income countries do not have sufficient capital to develop resources that can be sustainable because these types of resources tend to be expensive. Therefore, developing countries depend on replacing these resources as they enter the next phase, which is way more developed and has better stable economic activity. This result aligns with the findings of Alvarado et al. (2018) and Vo (2022), who suggested that the industrial sector contributes to excessive pollution. As a result, this has led to increased emissions in middle-income countries. Additionally, middle-income countries tend to delay environmental policies until their economy improves, as they assume large capital is needed for implementation (Rosa, 2020).

Environmental degradation is worse in high-income countries due to over-industrialization and resource depletion, leading to the accumulation of adverse environmental impacts throughout a country's development. These adverse impacts become irreversible and increase with economic activity. The country is too late in using resources that can be sustainable, while the non-renewable natural resources have already been depleted. The increase in industrial activity will harm the environment, but it cannot be stopped as it is a major contributor to the country's economy. It takes a large amount of capital to make it sustainable and closing it has a significant economic impact. This indicates that high-income nations are confronted with a significant environmental challenge. High-income countries must decide whether to invest a considerable amount of capital in renewable energy or halt production activities, as it may be too late to restore the environment to its natural state. The only viable solution is to minimize the harmful effects (Widianingsih et al., 2024). Therefore, the concept of growing first and clean up later backfires on the

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country itself as it eventually becomes accumulated and irreparable in the end. The clean-up later is already too late in the high-income country phase and tends to require much more capital than if it was done from the beginning. The results of this study are in line with Ishii et al. (2024) that high-income countries will have the worst environmental degradation due to all economic activities that have been carried out without considering the sustainability of the environment itself from the beginning so that it becomes a burden at the end.

CONCLUSION AND SUGGESTIONS

Countries with high income levels tend to have the worst environmental degradation. No country successfully achieves high economic development (as measured by the Human Development Index) while maintaining high levels of environmental degradation (as measured by global commons stewardship). Therefore, low and middle-income countries must develop strategies to promote economic growth without harming the current environment. Countries with high income levels tend to have the most significant impact on global commons due to industrial development and excessive resource consumption.

Current evidence suggests that the Environmental Kuznets Curve does not apply to the world economy nowadays, as many countries prioritize economic growth without considering the level of environmental degradation. The idea of prioritizing grows first and cleaning up later has not been proven beneficial, as not every country has been able to carry out the clean-up phase due to high costs and irreversible damage. Therefore, low-income, and middle-income countries should focus on the balance between economic development and environmental preservation before it's too late. On the other hand, high-income countries must shift immediately towards sustainable industries and reasonable consumption.

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