

Relationship Between Environmental Degradation, Economic Factors, And Tourism Indicators In Priority Tourism Destination Provinces In Indonesia

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Abstract

The tourism sector is one of the important sectors in increasing economic growth in Indonesia. However, in addition, the tourism sector can also indirectly cause negative effects, namely environmental degradation in the form of carbon emissions caused by several tourism activities. This study aims to analyze the influence of carbon emissions, GRDP which is one of the economic factors, the number of foreign tourists which is one of the tourism indicators, and the population in five provinces that are priority tourist destinations in Indonesia in 2010 - 2019, and also see the long-term influence between related variables. This study uses panel data with a quantitative approach that is analyzed with several tests, including the residual normality test, panel unit root test, cointegration test, and FMOLS test. The results of the study indicate that the GRDP and number of foreign tourists variables have a positive and significant effect, while the energy consumption and population variables have a negative and significant effect. The cointegration and FMOLS tests show that in this study there is a long-term effect between GRDP, the number of foreign tourists, energy consumption, population, and carbon emissions in five priority tourist destination provinces in Indonesia.

Keywords: *Tourism, Carbon Emissions, Energy Consumption, Economic Growth.*

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INTRODUCTION

Tourism is currently classified as a daily human need. Growth in the tourism sector continues to increase in the global economy, with international tourist arrivals growing 5% in 2018 by around 1.4 billion people and generating around 1.7 trillion USD per year (World Tourism Organization, 2019). According to the World Economic Forum in May 2022, Indonesia's tourism ranking rose rapidly in 2022 (Chanthawong & Choibamroong, 2022). From a macro economic perspective, the goal of development is to improve social welfare, one way to improve welfare is to increase economic growth (Suparta & Malia, 2020). Tourism development also encourages and accelerates economic growth, creating demand, both consumption and investment, both of which will give rise to production activities for goods and services. Tourism influences economic growth through several channels (Brida, 2014). First, the tourism sector as a foreign exchange earner to obtain capital goods used in the production process. Second, tourism development stimulates investment in infrastructure. Third, tourism contributes to employment opportunities and increased income (Lee & Chang, 2008). PDRB is one of the indicators of economic growth in a region.

PDRB can describe the ability of a region to manage its natural resources. The higher the PDRB of a region, the greater the potential income of the region (Nabila, 2015).

The arrival of foreign tourists to Indonesia is one of the factors that can influence GDP, because tourists buy souvenirs while in Indonesia and use transportation which can improve the economy (Roni & Iswandi, 2020). According to data from the Ministry of Tourism and Creative Economy, the number of foreign tourists visiting Indonesia has an increasing trend in the last few months, although entering 2020 there was a drastic decline due to the Covid pandemic. However, entering 2022, the arrival of foreign tourists to Indonesia has increased again, even increasing by 251.28% compared to 2021. With the expansion of the tourism sector, it not only affects national economic growth, but also affects the increase in energy consumption (Tsai et al., 2017). The negative externality impacts caused by a company include a decrease in the quality of the environment due to damaged natural resources, water and air pollution as a form of pollution (Ratih & Gurnita, 2019). Environmental quality can be measured by the level of carbon dioxide (CO₂) emissions, where CO₂ this affects the level of pollution (Putri et al., 2022). In addition, growth in the tourism sector may also have an indirect effect on greenhouse gas (GHG) emissions through several tourism activities that can increase energy use, including land transportation, aviation, use of electronic devices, accommodation, and management of tourist attractions, which also lead to environmental pollution and degradation. Energy consumption and carbon emissions from transportation are major contributors to total emissions in the tourism industry.

Population growth and population density also affect environmental quality, energy consumption and carbon emission contributors in Indonesia. With a fixed area and a population that continues to grow every year, Indonesia's population density increases every year. Historical statistics show that population growth is directly proportional to economic growth, energy consumption and greenhouse gas emissions (Maria, 2021). The increase of CO₂ emissions indicates that all human activities have an impact on the environment, especially economic activities. All the negative effects of economic activities are often ignored, even it is not included in the company's economic calculations. That impact is called a negative externality which is very detrimental if it is always ignored (Emalia et al., 2020). With the continued increase in population, it will affect green open areas, the increasing amount of waste (household waste), then energy consumption, whether from transportation activities, electricity use, or the use of electronic media which indirectly affects environmental damage and produces carbon emissions (Aakhirul et al., 2020).

LITERATURE REVIEW

Environmental Kuznets Curve (EKC)

The relationship between the stages of economic development and environmental degradation in the form of a Kuznet curve known as the Environmental Kuznet Curve - EKC which is divided into three stages, the first stage of economic development will be followed by increased environmental damage known as pre-industrial economics, the second stage is known as industrial economics, and the third stage is known as post-industrial economics (Panayotou, 2001). The EKC theory explains that economic growth will initially increase environmental degradation. The production process that is carried out continuously will then result in environmental degradation in the form of pollution of water, air, and land. At a certain point, economic growth then makes society aware that the need for good environmental quality is important. This point is called the turning point where economic growth will reduce environmental degradation (Kuznets, 1955).

Carbon Emissions

According to the Cambridge dictionary, emissions are a number of gases, heat, light and others that are sent out. Carbon emissions are gases produced from the combustion of

carbon-containing compounds such as CO₂, diesel, LPG, gasoline, and other fuels (Darajati et al., 2022). Carbon dioxide emissions are one type of greenhouse gas (GHG) emissions that cause global warming (Labiba & Pradoto, 2018). The production of carbon dioxide (CO₂) emissions is related to daily human activities. There needs to be mitigation efforts to control all activities that can produce a lot of CO₂, both from policy makers and groups that have interests in the field (Braunschweig & Gani, 2002). The Intergovernmental Panel on Climate Change (IPCC) states that there are at least 5 sectors of human activity that are sources of carbon dioxide (CO₂) emissions, including energy consumption, industrial processes and product use, agriculture and land use, and waste.

Foreign Tourists

Tourists are people who travel from their place of residence to visit another place by enjoying the journey of their visit (Riani, 2021). Meanwhile, Law Number 10 of 2009 defines tourists as people who carry out tourism activities. Foreign tourists are foreigners who travel, who come to another country that is not the country where the tourist resides. Foreign tourists for a country can be identified by their citizenship status, the travel documents they have and the type of currency they spend, because in general this group of tourists almost always exchanges their money first at a Bank or Money Changer before shopping. The tourism sector is a contributor to carbon dioxide (CO₂) emissions through several activities, including transportation and accommodation, which can produce greater carbon emissions than other activities (Shaheen et al., 2019).

Electric Energy Consumption

According to Frick and Setiawan (2002), electricity is energy that can be converted into other energy, producing heat, light, chemical, or motion (mechanical). The usefulness of electricity is very visible in daily activities such as turning on lights and other electronic devices. Electrical energy or electric power is one of the main types of energy needed for electrical equipment or energy stored in electric current with units of ampere (A) and electric voltage with units of volt (V) with the provision of electricity consumption needs with units of Watt (W) to drive motors, lighting, heating, cooling or re-driving a mechanical device to produce other forms of energy. The energy produced can come from various sources, such as water, oil, coal, wind, geothermal, nuclear, solar, and others.

Economic Growth

According to Joko Untoro in the book *Macroeconomics* (2010), economic growth is the development of activities in the economy that causes goods and services produced in society to increase and the prosperity of society to increase in the long term. Meanwhile, according to Sadono Sukirno in his book *Macroeconomics: Introductory Theory* (2010), economic growth is the development of activities in the economy that causes goods and services produced in society to increase and the prosperity of society to increase. Currently, rapid economic growth accompanied by industrial growth that is also developing has resulted in increased air pollution that can affect global warming and decrease environmental quality. Economic growth is indeed very much needed in a country, but maintaining the growth of environmental conditions is also necessary for human survival and preventing global warming. Economic growth tends to cause negative effects on the environment and its impacts will continue to be visible in the long term (Kolstad & Krautkraemer, 1993).

Total population

Population according to the Central Statistics Agency (BPS) is all people who are domiciled in the geographical area of the Republic of Indonesia for 6 months or more and or those who are domiciled for less than 6 months but intend to settle. Increasing population in an area can result in environmental degradation or erosion of natural resources which are

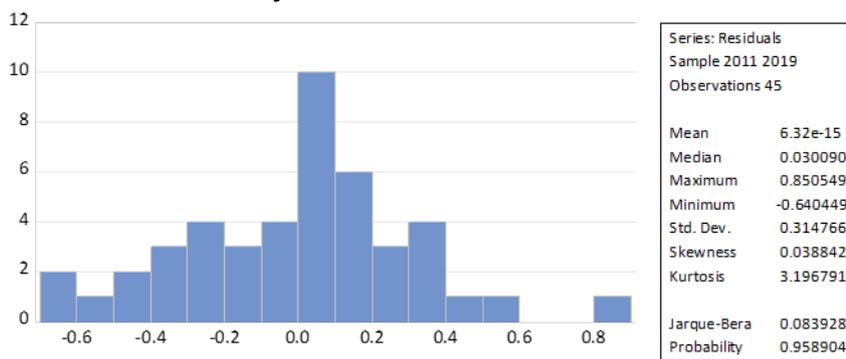
very limited in number (Yulin & Dita, 2022). The higher the population growth in an area will be followed by the increasing needs that must be met. Thus, the production process of goods and services will also increase. The impact of the increasing scale of production will also increase the production waste that will pollute the environment. Therefore, the increasing population growth in an area will result in environmental degradation.

METHOD

This study is a quantitative approach. The data used is secondary data with panel data type. Time series data comes from 10 years of data, namely 2010 - 2019. Cross section data comes from 5 provinces in Indonesia, namely North Sumatra, Central Java, West Nusa Tenggara, East Nusa Tenggara, and North Sulawesi. The data used in this study is secondary data from the Central Statistics Agency (BPS), the Ministry of Tourism and Creative Economy (Kemenparekraf), and the Ministry of Environment and Forestry (KLHK). This study uses four independent variables, namely GRDP, number of foreign tourists, energy consumption, and population. The data analysis method in this study is with panel unit roots to see the stationarity between data in the study and the panel cointegration method, namely Fully Modified Ordinary Least Square (FMOLS) to see the long-term effect between independent variables and dependent variables, then residual normality test and hypothesis testing.

RESULTS AND DISCUSSION

Residual Normality Test



Based on the results of the normality test after data transformation with Natural Logarithm (LN), the results obtained are that the prob value is 0.958904 > 0.05, which means that the data is normally distributed. So that the data that has been transformed into the form of natural logarithm will also be used in further analysis in this study.

Unit-Root Panel Test (Phillips Perron)

Variables	PP stat.	Probability	Hypothesis	Caption
LN_EK	28.0230	0.0018	Reject H ₀	Stationary
LN_PDRB	24.9273	0.0055	Reject H ₀	Stationary
LN_JWA	20.0346	0.0289	Reject H ₀	Stationary
LN_KE	21.8810	0.0157	Reject H ₀	Stationary
LN_JP	67.8156	0.0000	Reject H ₀	Stationary

The results above show that all variables have been stationary and reject H₀ at the level level. This is because all variables have a significant probability value at α of 5 percent. The follow-up analysis of the stationarity test is that a cointegration test needs to be conducted on related variables to see whether or not there is a long-term relationship between the variables.

Cointegration Test (KAO)

Method	Statistics	Probability
ADF	-1.903906	0.0285

Based on the probability values above, it can be concluded that all variables tested in this study are cointegrated or have a long-term relationship. Based on the results of the data stationarity test and the cointegration test, the analysis tool used is the FMOLS (Fully Modified-OLS) panel data analysis, which aims to see the long-term influence between the variables used in this study.

Fully Modified-OLS (FMOLS) Test

The results of the analysis of the relationship between the variables of GRDP, number of foreign tourists, energy consumption, and population with the carbon emission variable using the FMOLS (weighted) panel method can be seen in the table below.

Variables	Coefficient	Standard Error	Probability
LN_PDRB	4.684236	0.006830	0.0000
LN_JWA	0.207632	0.017064	0.0000
LN_KE	-1.026387	0.022144	0.0000
LN_JP	-11.60992	0.013756	0.0000

The table above shows that the results of the FMOLS test obtained a probability for the research variable which is smaller than $\alpha = 5\%$, which means that the independent variable has a significant long-term effect on the dependent variable.

Hypothesis Testing (t-statistic test)

Independent Variable	Dependent Variable (Y) = Carbon Emissions			
	t-statistic	t-table	Probability	Information
LN_PDRB	685.8673	1,679	0.0000	H ₀ is rejected
LN_JWA	12.16813	1,679	0.0000	H ₀ is rejected
LN_KE	-46.34959	1,679	0.0000	H ₀ is accepted
LN_JP	-844.0181	1,679	0.0000	H ₀ is accepted

Based on the table above, all variables show a significant influence. There are two variables that show positive results, namely GRDP and the number of foreign tourists. The variables of energy consumption and population show a negative influence

F-statistic test

DF	F-table	F-statistic	Prob.	Information
(4; 36)	2.63	11926924	0.0000	H ₀ is rejected

Based on the results above, it shows that this test rejects H₀ because the magnitude of the F statistic is greater than the F table and the probability level is lower than the significance level, which means that all independent variables together have an effect on the dependent variable.

Determinant Coefficient (R²)

Based on the FMOLS test, the determinant coefficient (R²) was obtained as 0.953726, which means that overall the independent variables, namely GRDP, number of foreign tourists, Relationship Between Environmental Degradation, Economic Factors, And Tourism Indicators In Priority Tourism Destination Provinces In Indonesia

energy consumption, and population, can explain the influence of factors that influence carbon emissions in five priority tourist destination provinces in Indonesia in 2010 - 2019.

The Influence of GRDP on Carbon Emissions.

According to the Central Bureau of Statistics, Gross Regional Domestic Product (GRDP) is one of the important indicators to determine the economic conditions in a region in a certain period, both based on current prices and constant prices. Economic growth that can improve public welfare in general is a development target pursued by almost all regions. However, economic growth itself can sometimes create negative externalities that can reduce public welfare. In the case of massive negative externalities such as climate change due to carbon emissions (Noor & Saputra, 2020).

This study has results that are in accordance with the research conducted by Hela and Ekawaty (2024) which explains that the GRDP of Central Java Province in several sectors has a significant influence on the industrial sector. The significant and positive influence of the GRDP of the industrial sector on CO₂ emissions in Central Java is due to the increasing value of the GRDP of the industrial sector, one of which is marked by the rapid development of industrial areas in Central Java (Hela & Ekawaty, 2024).

The Impact of the Number of Foreign Tourists on Carbon Emissions.

The growth of the tourism sector has an indirect effect on greenhouse gas (GHG) emissions through several tourism activities that can increase energy use, including land transportation, flights, use of electronic devices, accommodation, and management of tourist attractions, which also lead to environmental pollution and degradation (Rahmayani, 2021). According to the Ministry of Energy and Mineral Resources in 2022, energy consumption and carbon emissions from transportation are the main contributors to total emissions in the tourism industry.

The results of this study are in line with research conducted by Duyen Thi (2023) which explains that international tourism has a positive impact on carbon emissions in high-income countries and middle and low-income countries. This indicates that the increasing number of international tourism causes a decline in environmental quality. It can also be explained because attracting tourists contributes to economic development, however, some tourism-related activities have not paid attention to environmental quality (Thi et al., 2023).

The Impact of Energy Consumption on Carbon Emissions

Based on data from the Ministry of Energy and Mineral Resources, it can be seen that final energy consumption in Indonesia has experienced a fluctuating increase. The industrial and transportation sectors are the largest contributors to energy consumption in Indonesia. Several factors that cause the research results to show a negative impact, namely government policies and significant differences in data in each province. Various policies have been implemented by the government to reduce energy consumption in the long term. Indonesia's strength lies in the policy that requires the implementation of energy management based on the ISO 50001 standard for large-scale energy users. In addition to the implementation of energy management based on the ISO 50001 standard, the government's role in forming a policy framework can also be in the form of developing a national strategy and policy framework that supports Indonesia in achieving its net zero emission goals, and policies stated in Presidential Regulation No. 112 of 2022 concerning the Acceleration of Renewable

Energy Development for Electricity Supply. Based on the data, there are two provinces that have above average Energy Consumption values. Central Java Province is 24750.62 GWh and North Sumatra is 10324.86 GWh. The maximum value is occupied by Central Java Province at 24750.62 GWh and the minimum value is occupied by East Nusa Tenggara Province at 338.4 GWh.

The results of this study are in line with research conducted by Inggia and Kasman (2023) which found that energy consumption has a negative and significant effect on environmental degradation in Indonesia from 1990 to 2020. These findings indicate that when energy consumption by the community or the industrial world increases, environmental degradation in the form of CO₂ emissions will relatively decrease (Sari & Karimi, 2023). This situation is caused by the government realizing that household or industrial use is increasing, this phenomenon encourages the government to implement strict regulations on industry or households in the use of energy including waste produced in gas discharge.

The Effect of Population on Carbon Emissions

According to data from the Central Statistics Agency (BPS), the population in Indonesia tends to increase every year. With the increasing population, it is certain that there will also be an increase in activities carried out by the community. In their activities, humans will use fuel, be it oil, gas, and/or fossils, combustion activities, and even deforestation. The activities carried out are a way to meet their needs, both socially and economically (Prinadi et al., 2022). This causes environmental degradation in the form of air pollution, global warming, and also household waste disposal. There are several factors that cause this study to show negative results, including the growth rate and population density. The data shows that the population growth rate in the five priority tourist destination provinces in Indonesia. Although the population increases every year, the population growth rate has experienced a downward trend in the last few years each year. The population density in the five provinces also has quite significant differences. According to data from the Central Statistics Agency in 2019, the population density of East Nusa Tenggara Province was 112 people/KM², North Sulawesi Province 181 people/KM², North Sumatra Province 200 people/KM², West Nusa Tenggara Province 273 people/KM², and the highest was Central Java Province with 1,058 people/KM².

The results of this study are in line with research conducted by Bagus and Rahman (2022) which states that long-term population growth has a negative and significant effect on carbon emissions in Indonesia from 1986 to 2019. The long-term negative relationship between population growth and carbon emission levels is thought to be caused by a decline in the rate of population growth in Indonesia from 1986 to 2019, although the population continues to grow, the rate of population growth has a downward trend from year to year (Bagus Putra & Rahman, 2022).

CONCLUSION

1. The long-term estimation results show that there is a long-term relationship between GRDP, number of foreign tourists, energy consumption, population, and carbon emissions in 5 priority tourist destination provinces in Indonesia.
2. GRDP and the number of foreign tourists partially have a positive and significant effect on carbon emissions in 5 priority tourist destination provinces in Indonesia.

Energy consumption and population have a negative and significant effect on carbon emissions in 5 priority tourist destination provinces in Indonesia.

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