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ANALYSIS OF THE IMPACT OF CLIMATE CHANGE ON THE TOURISM SECTOR OF ASEAN COUNTRIES IN 2005 - 2019

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ABSTRACT

Climate change impacts the tourism sector and affects the economic sector. With climate change, the number of tourist arrivals declined. It also affects the economic sector, especially gross domestic product and per capita income, which is impacted due to a decline in tourism demand. The study aimed to determine the impact of climate change in temperature and rainfall, gross domestic product, and per capita income on the number of tourist arrivals in 10 ASEAN countries in 2005 - 2019 variables. The research method used was panel data analysis with Random Effect Model (REM). This model was chosen as the best model based on the test results in the panel data. This study is a quantitative study with a times series of 2005-2019 and a cross-section of Ten ASEAN Countries. The results of this study indicate that the temperature variable positively affected the number of tourist arrivals. In contrast, the rainfall variable negatively affected the number of tourist arrivals, and gross domestic product and income per capita variables positively affected the number of tourist arrivals.

Keywords: *Climate Change, Income per capita, Gross domestic product, Random Effect Model*

1. INTRODUCTION

The tourism sector is one of the most important sectors in the economic growth of a country. This sector provides a large amount of foreign exchange and generates jobs directly and indirectly through economic diversification. The tourism sector has considerable linkages with other economic sectors, which ultimately contribute to the growth of tourism-related activities such as agriculture, fisheries, industry and services, and transportation (Wilkins et al., 2018). In many archipelagic countries, such as in the ASEAN region, the tourism sector is a major contributor to economic growth and causing the entry of foreign currency and job creation.

The ASEAN region has a rich and diverse array of cultural tourism resources, tangible and intangible, located in rural and urban areas. The region's 11 natural and 17 cultural heritage sites are listed on the UNESCO World Heritage List. Its natural heritage is a rich and diverse endemic ethnic culture with Arab, Chinese, Indian and European influences. Buddhist, Hindu, Muslim, and Christian traditions, vernacular architecture, music, and literature attract many tourists (Secretariat, 2020).

The Tourism sector is a vital component of the economies of all ASEAN Member States, especially in Cambodia, Laos, Malaysia, the Philippines, and Thailand, where tourism accounts for more than 10% of GDP and contributes significantly to employment in their economies. According to WTTC, in 2018, ASEAN Member States generated US$112.6 billion in tourism exports or foreign exchange earnings and $294.4 billion in value-added related to travel and tour operations, shopping, entertainment, transportation, various other tourism-related services jobs, and the productive sector contributing 12.30% of GRDP. In 2018, the number of tourists who came to the ASEAN region was 135 million and increased in 2019 by 143 million tourists. Such improvements can be seen in the following table:

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Table 1. Number of Tourists in ASEAN in 2014 – 2019

Year	Number of Tourist
2014	105.038.800
2015	108.903.800
2016	115.566.400
2017	127.721.000
2018	135.169.700
2019	143.487.500

Source: *ASEAN Statistics Yearbook*, the data was processed in *2020*

The tourism sector gained considerable attention from many governments of developing countries because it is often considered a source of economic growth and development, which is potentially promising to promote human development (Fauzel, 2017). The significant influence of the tourism sector on economic growth has led many researchers to study the factors that determine the development of the tourism sector. Among them are factors of tourist income, relative prices, political stability, socio-cultural and economic relations between countries, tourism and other infrastructure, and liberalization of air access. Recently, increasing attention has been paid to the effects of climate change on tourist arrivals. Tourism is an industry that does not consider climate change, but if there is a change in air pressure and rising sea level, it can cause unexpected natural disasters (Secretariat, 2006).

The impact of climate change on the tourism sector, especially for archipelagic countries, will be very significant. Rising sea levels accompanied by coastal erosion, degradation of coral reefs, and loss of coastal cultural heritage due to flooding will reduce tourist attraction. Climate change can have a negative impact on the amount of available water and lead to the emergence of certain diseases (Seetanah, 2018). This has reduced the interest of tourists to go to small islands. Warm climatic conditions can also reduce the number of tourists visiting. In addition, the climate is an important factor for tourists in choosing a vacation destination (Hamilton, 2005).

Tourism destinations and tourism operators are affected by climate variability and change in several ways. All tourist destinations are climate-sensitive to some degree, being influenced by natural seasonal demand, positively or negatively affected by interannual climate variability that brings heat waves, unseasonable cold, drought or storms, and heavy rains, which can affect not only the comfort and safety of tourists (Scott and Lemieux, 2010).

The increase in tourism demand stimulates the quantity of supply of tourist destinations (Fauzel, 2017). Furthermore, the transportation revolution has positively affected the immigration of human resources and commercial logistics, thereby changing the supply of the tourism industry, as reflected in the development of almost every business across the industry (Schubert, Brida, and Risso, 2011). As a result of increased accessibility, the demand for tourism and the number of tourists has increased, but the number of tourists, lodging, and social places has increased, thus having a significant impact on tourism growth in the economy.

The increase in the number of tourist arrivals makes the Gross Domestic Product (GDP) also increase. Because the community's economic activities can be absorbed by tourists, other than that, service providers such as transportation and lodging also have a direct impact on tourist arrivals (Li and Chen, 2020). Tourism's contribution to the broadly defined gross domestic product (GDP) of tourism accounts for between two and 12% of GDP in developed and diversified economies, and up to 40% of GDP in developing countries, and up to 70% of GDP in small island countries (Ashley, 2007).

The tourism sector cannot develop without tourists. With the arrival of tourists, it will revive the economy, such as small hotels, large hotels, tour operators, travel agents, ground handlers, cruise ships, airlines, car rental and transportation, local guides, and various recreational and entertainment services (Ashley, 2007).

The arrival of tourists has an income effect on local residents. Those effects of tourist consumption in hotels, restaurants, and transportation are on household wages, taxes, savings, consumption, and net income. So that national tax revenues also increase (Tohmo, 2018). The arrival of tourists is influential and influenced by per capita income from the tourist country of origin and the destination country (Seetanah, 2018).

2. RESEARCH METHOD

This study used secondary data. Secondary data is data obtained indirectly through literature studies of library materials and from existing data. Secondary data is not obtained directly by data collectors but through other people or documents (Seetanah, 2018). Climate change data were obtained from the World Bank 2019 data, and data on the gross regional product, per capita income and the number of tourist arrivals were obtained from the 2019 Asian Statistics Yearbook

This study used the Data Panel method, a combination or combination of time series, namely data from 2005 to 2019, and cross-sections from 10 ASEAN countries (Kosmaryati, 2019). In the model equation of panel data regression, the model can be formulated as follows:

$$Yit = \beta 0 + \beta 1\ X1it + \beta 2\ X2it + \beta 3\ X3it + \beta 4\ X4it + \varepsilon it$$

where :

Y : Number of tourist arrivals
i : ASEAN member states
t : Time (2005 to 2019)
β0 : Constant
β1- β4 : Coefficient
X1 : Income per capita
X2 : Gross domestic product
X3 : Temperature
X4 : Rainfall
ε : Standard error

There are three types of approaches in panel data regression, namely the Common Effects Model, Fixed Effects Model, and Random Effects Model. The regression model selection was carried out to determine the most appropriate model used in research (Srihardianti, 2016). Three tests were carried out to choose panel data estimation techniques, namely the Chow test, Hausman test, and the Lagrange Multiplier (LM) test. Statistical tests and R^2 determination tests were also conducted.

3. RESULTS AND DISCUSSIONN

3.1. Result

Table 2. Descriptive Statistics of Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Negara	0				
ID	150	5.5	2.881904	1	10
Tahun	150	2012	4.334968	2005	2019
Y	150	9483599	9596140	127000	3.98e+07
X1	150	10611.06	16423.99	217.5943	66188.78
X2	150	2.16e+11	2.42e+11	2.74e+09	1.12e+12
X3	150	25.87235	1.444002	23.01	29.09
X4	150	196.093	54.0909	104.77	333.09

It can be seen from Table 1 that the highest and lowest values of the X1 variable or per capita income variable are 66188.78 USD and 217.5943 USD, respectively, with an average per capita income of 10611.06 USD. In the X2 variable or the gross domestic product variable, the highest and lowest values are 1.12e+12 USD and 2.73e+09 USD, with an average gross domestic product of 2.16e+11 USD. For the X3 variable or the temperature variable, the highest and lowest values are 29.09 Celsius and 23.01 Celsius, with an average temperature value of 25.87 Celsius. In the X3 variable or the rainfall variable, the highest and lowest values are 333.09 mm and 104.77 mm, respectively, with an average rainfall value of 196.093 mm. For variable Y or the variable number of tourist arrivals, the highest and lowest average values are respectively 3.98e+07 tourists and 127,000 tourists, with an average value of 9,483,599 tourists.

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Best Model Test

a. Chow Test
From the Chow test regression, the statistical value of chi-square is 61.68 with a probability value of 0.0000, 0.0000 <0.05 (α 5%) was obtained. Based on the regression results, Ho was rejected, and Ha was accepted. The conclusion of the Chow test shows that Fixed Effect Model is better than Common Effect Model.

b. Lagrange Multiplier (LM) Test
From the Lagrange Multiplier test regression, Breusch-Pagan (BP) prob. value of 611.95 with a probability value of 0.0000, 0.0000 < 0.05 (α 5%) was obtained. Based on the regression results, Ho was rejected, and Ha was accepted. The conclusion from the Lagrange Multiplier Test shows that Random Effect Model is better than Common Effect Model.

c. Hausman test
From the Hausman test regression, the Chi-sq statistic value of 1.16 with a probability value of 0.5610. 0.5610 > 0.05 (α 5%) was obtained. Based on the regression results, Ho was accepted, and Ha was rejected. The conclusion of the Hausman test shows that Random Effect Model is better than Fixed Effect Model.

Random Effect Model

Table 3. Random Effect Model

Random-effects GLS regression — Number of obs = 150
Group variable: ID — Number of groups = 10

R-sq:
within = 0.4791
between = 0.2442
overall = 0.2824

Obs per group:
min = 15
avg = 15.0
max = 15

Wald chi2(4) = 127.76
corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0000

Y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
X1	312.8614	65.27845	4.79	0.000	184.918	440.8048
X2	.0000227	3.07e-06	7.40	0.000	.0000167	.0000288
X3	945666.1	858086.4	1.10	0.270	-736152.3	2627485
X4	-18145.07	15591.45	-1.16	0.245	-48703.76	12413.62
_cons	-1.97e+07	2.35e+07	-0.84	0.402	-6.57e+07	2.63e+07
sigma_u	9571045.1					
sigma_e	3599943.2					
rho	.87606126	(fraction of variance due to u_i)				

a. Analysis of Panel Data Regression
The best model from the regression results is the Random Effect Model. Based on the results of the Random Effect Model regression, the regression model equation can be written as follows:

b. Classical Assumption Test
A classical assumption test is not needed in panel data analysis because panel data can minimize biases that are most likely to appear in the analysis results and provide more information. Because the model results obtained are random effects, the classical assumption test was not carried out because the random-effects model is a generalized least square (GLS) estimation method. The GLS technique is believed to overcome the autocorrelation of time series (time series) and correlation between observations (cross-section) (Kosmaryati, 2019).

c. F-Statistic Test
The F-statistic value contained in the table was obtained at 127.76 with a probability value of 0.0000. 0.0000 < 0.05 (α). The conclusion is that, together, the variables of Gross Domestic Product, Income per capita, Temperature, and Rainfall have a significant effect on the Number of Tourist Arrivals.

d. t-Statistic test
The t-statistic test explains the independent variables by comparing the probability value of t with 5%. The conclusion of rejecting or accepting the results of the t-test is shown in the following table.

Variable	Probability	Information
Income per capita (X1)	0,000	Significant
Gross Domestic Product (X2)	0,000	Significant
Temperature (X3)	0,270	Not Significant
Rainfall (X4)	0,245	Not Significat

The results of the t-test in the random effects model table above are as follows:

1) The t-statistic test of the income per capita variable (X1)
The t-statistic value of the income per capita variable in the random effects table is 4.79, with a probability value of 0.000. 0.000 < 0.05 (α 5%) . This means that statistically, income per capita data has a positive and significant effect on the number of tourist arrivals.
2) The t-statistic test of the Gross Domestic Product variable (X2)
The t-statistic value of the Gross Domestic Product variable in the random effects table was obtained at 7.40 with a probability value of 0.000. 0.000 < 0.05 (α 5%) . This means that statistically, the Gross Domestic Product data has a positive and significant effect on the number of tourist arrivals.
3) The t-statistic test of the Temperature variable (X3)
The t-statistic value of the Temperature variable in the random effects table was obtained at 1.10 with a probability value of 0.270. 0.270 > 0.05 (α 5%). This means that statistically, the temperature has a positive and insignificant effect on the number of tourist arrivals.
4) The t-statistic test of the Rainfall variable (X4)
The t-statistic value of the Temperature variable in the random effects table was obtained at -1.16 with a probability value of 0.245. 0.245 > 0.05 (α 5%). This means that statistically, Rainfall has a negative and insignificant effect on the number of tourist arrivals.

3.2. Discussions

a. Income per capita on the number of tourist arrivals
The Random Effects model regression results show that the coefficient value of the Income per capita variable of 312,8614 has a positive and significant influence on the number of tourist arrivals with a significance less than 5%. This means that if there is an increase in per capita income of 1 US dollar, it will increase the number of tourist arrivals by 312.8614 tourists.

b. Gross domestic product on the number of tourist arrivals
The Random Effect model regression results show that the coefficient value of the variable Gross Domestic Product is 0.0000227, has a positive and significant influence on the number of tourist arrivals with a significance smaller than 5%. This means that if there is an increase in the gross domestic product by 1 US dollar, it will increase the number of tourist arrivals by 0.00000227 tourists.

c. Temperature on the number of tourist arrivals
The Random Effect regression model results show that the coefficient value of the Temperature variable is 945666.1, has a positive and insignificant effect on the number of tourist arrivals with a significance greater than 5%. This means that if there is an increase in temperature of 1˚ Celsius, will increase the number of tourist arrivals by 945,666.1 tourists.

d. Rainfall on the number of tourist arrivals
The Random Effect regression model results show that the coefficient value of the Rainfall variable is -18145.07, has a negative and insignificant effect on the number of tourist arrivals with a significance greater than 5%. This means that if there is an increase of rainfall of 1 mm3, there will be a decrease in the number of tourist arrivals amounted to 18145.07 tourists.

4. CONCLUSIONS

Based on the results of this research, the results obtained are:

a. The income per capita variable has a *p-value* and a coefficient of 0.000 and 312.8614, respectively. Based on these data, the income per capita variable has a positive and significant effect on the number of tourist arrivals from ASEAN countries. The results of this study are in accordance with research conducted by Li and Chen (2020).
b. The gross domestic product variable has a *p-value* and coefficient of 0.000 and 0.0000227, respectively. Based on these data, the gross domestic product variable has a positive and significant effect on the number of tourist arrivals from ASEAN countries. The results of this study are in accordance with research conducted by Guo, Robinson, and Hite (2017).
c. The temperature variable has a *p-value* and coefficient of 0.270 and 945666.1, respectively. Based on these data, the temperature variable has a positive and insignificant effect on the number of tourist arrivals from ASEAN countries. The results of this study are in accordance with the research conducted by Eusébio et al. (2020).
d. The rainfall variable has a *p-value* and coefficient of 0.245 and -18145.07, respectively. Based on these data, the rainfall variable has a negative and insignificant effect on the number of tourist arrivals from ASEAN countries. The results of this study are not in accordance with the research conducted by Eusébio et al. (2020).

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