Investigating the Impact of International Tourist Arrivals on Economic Growth under Environmental Hazards in Malaysia

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Abstract—Tourist receipts is a crucial determinant in Malaysian economic growth. However, environmental hazards due to climate change is perceived as potential threats to tourism. This paper aims to understand the effect of environmental hazards on the international tourist arrivals in Malaysia. Malaysian monthly data was analyzed using the linear regression approach to examine the tourism-led economic growth. Granger Causality Test is employed to test for directional cause analysis among variables. Overall results also show that an increase in environmental hazards that moderated with international tourist arrivals leads to a lower Malaysian economic growth in Malaysia. Meanwhile, better air quality boosts the number of international tourist arrivals, hence stimulates Malaysian economic growth. Granger causality results indicate that there exists a bidirectional cause between international tourist arrivals and climate change (temperature, and thunderstorm) but a unidirectional causality exists between international tourist arrivals and economic growth, carbon emission, air quality and rainfall, respectively. Effective mitigation of climate change needs to be implemented by the authorities to reduce the environmental risk.

Index Terms—International tourist, economic growth, environment hazards, Malaysia.

I. INTRODUCTION

In Malaysia, tourism is the greatest and rapid growing amongst other industries. The government has made great efforts to promote the progress of tourism industry which is parallel to the objective of the Economic Transformation Program to revolutionize from a resource-based economy to a service-based economy. The total contribution of tourism industry in Malaysia is 240.2 billion ringgit or 15.9 percent of national income in year 2019 [1].

The impact of natural environmental deterioration on destinations and tourism operations are closely related with tourist behaviour. In spite of tourism significance affect to economic growth, one might also expect environmental hazard that may endanger tourism activity. The environmental quality is one of the key aspects influencing travel motivations and destination selections [2]. There is a substantial evidence manifesting the extrinsic vital of climate and weather for tourist decision-making, including destination choice, motivations and travel timing as well as experience [3].

Environmental risks may include carbon dioxide emissions, radiation, air quality index and climate change (temperature, humidity, sea level pressure, wind speed, storm and rain fall). Tourism activities can be extremely disruptive by bad environment [4], play dominant roles in safety management [5] and also transfer the disease that affect human health [6]. Apart from that, tourism activities can cause pollution, destroy natural habitat and endanger species eradication. Tiwari *et al.* [7] discovered that the relationship between tourism and climate change is bidirectional, that is, climate change influences tourism activities and vice versa. Environmental hazard such as climate change is perceived as a potential threat to the tourism resources such as highlands, beaches, flora and fauna, cultural infrastructures and physical infrastructure. The world is recording extreme weather conditions, resulting in more severe droughts, floods, threatening hurricanes and other natural disasters affecting entire countries. The impact of climate change on the tourism sector is expected to be significant.

Although the contribution of tourism to economic growth has been extensively analyzed in the field of tourism economy, the studies on the environmental hazards that play a moderation role between Malaysia international tourism arrivals and economic growth has not been explored. It is vital to figure out their interrelationships effects to sustain the growth of the travel industry. Therefore, this study aims to focus on the research on Malaysia's tourism industry, environmental hazards and national development, so as to narrow the background and knowledge gap, and further study the relationship of selected variables.

II. LITERATURE REVIEW

Tourism Led Economic Growth (TLEG) means that from a positive long-run perspective, a unidirectional causality runs from tourism growth and increase to economic development. Previous empirical studies broadly supported the view that tourism contributes to economic development [8], [9]. Other study shows that tourism contributes to human capital growth and infrastructure investment in Latin American countries [10]. On the other hand, the theory of economy leads to tourism growth model implies that economic advancement brings to an increase in tourism revenue [11]. The rationale reason behind this argument is that rapidly economic growth, education and safety enhancement as well as tourism infrastructure upgrade in the country will attract more international tourist arrivals. Ridderstaat *et al.* [12] discovered a bidirectional relationship among tourism and economic development. However,

Kasimati [13] found a noncausal relationship that indicates tourism does not influence economic growth in Turkey and Greece respectively, and vice versa.

The link between CO_2 emissions and tourism growth is not clear. The evidence of empirical researchers show that the implementation of sustainable tourism or ecotourism not only does not contribute to the rise in CO_2 emissions, but reduce them [3]. The application of sustainable tourism development strategies lead to lower CO_2 emissions because new technologies utilize more hygienic energy and diminish emissions. The environment is inevitably impacted when tourism activities take place, since tourism activities affect natural environment transformations, resulting in environmental changes. Despite relying heavily on the natural environment, tourism activities may create bad environmental impact [14] Empirical studies have shown that tourism growth not only leads to higher energy consumption but also has contributed significant environmental pollution, especially CO_2 emissions by using the autoregressive distributed lag model method [15]. The results suggest that tourism activities not only positively influence economic development, but also increase CO_2 emissions. Ahmad *et al.* [16] indicate a negative relationship between tourism and CO_2 emissions indicators at some of the China provinces and reveal that tourism leads to an increase in CO_2 as well as greenhouse gas emissions.

Nevertheless, some studies use PM 2.5 [17] and PM10 [18] as representative of air quality. There are still lack of researches employing PM10 or PM2.5 indicators as representatives of air quality and link with tourism industry. Current air quality and tourism issues are focusing for China and Hong Kong [19]. There is no research that includes PM10 as an indicator measure of air quality in Malaysia, thus this study investigates both PM10 and CO_2 indicators on tourism demand and vice versa in Malaysia. PM10 AQ tests for air quality(AQ) whereas CO_2 tests for air pollutant.

Climate change has been defined as a major determinant for tourists' destination choice. Climatic elements such as sunshine, temperature, radiation, wind, precipitation, humidity and fog are major factors that influence tourism demand. Meanwhile tourists are sensitive towards weather and climate change and they have behavioral intention for climate change mitigation [20]. Other than that, climate change causes a variation in temperature which is the main factor that can affect food production and food quality, particularly in those countries that are most prone to drought and famine. This may also affect food ranger tourists on destination choice. On the other hand, tourism industry leads to climate change. Human activities such as tourism activities have increased 40 percent of CO_2 in the atmosphere, and other gases, such as methane by a factor of two to three or more within the past 200 years.

From the empirical studies, it is apparent that the relationships among tourism, economic development, CO_2 emission, climate change are not uniform. Most of the existing literature focuses on causal linkages among variables, but ignores their moderation effect and bidirectional relationship. In particular, studies examining the relationships among international tourist arrivals, economic growth and environmental hazard simultaneously in Malaysia remain scarce. This study tests the moderate effect of environmental hazards between international tourist arrivals and economic growth and also investigates the causality effect between environmental hazard, tourist arrivals and country development.

III. RESEARCH HYPOTHESIS

Tourism has a direct positive impact on economic growth, for example, higher incomes and employment rate will contribute to better economic growth. The tourism revenue earned by the government can be used to invest in industry to further promote economic growth in Malaysia. The development of tourism also has an indirect positive contribution on the growth of economy in terms of infrastructure investment and human capital development. Thus, the first hypothesis is as below:

H1: Tourism contributes to nation economic growth.

Weather and pollution have been recognized as major determinants of tourists' destination choice. Climate change will affect the tourism industry development and thus influence nation economic growth. Pollution elements such as air quality index and CO_2 emission will impact tourism performance and also public health. Pollution can cause negative psychological state of tourists, reduce the aesthetic of scenic spots, damage tourism experience, reduce tourism demand, and harm the development of tourism [21]. Consequently, the national economic growth will be influenced by the volume of international tourists as tourism industry is one of the biggest contributors to Malaysian economy. The following stated hypothesis test for a clear understanding of the impact of international tourist arrivals on Malaysian economic growth under environmental hazard.

H2: Environmental hazard moderates the relationship between Malaysia international tourist arrivals and economic growth (GDP), such that strong (less) environment risk leads to lower (higher) economic growth.

The economic-driven tourism growth model implies that the national economic development increases tourism revenue, builds better tourism infrastructure, improves national education and upgrades safety. These factors may then attract more international tourists to come to the country. On the other hand, tourism economics have proven that GDP has a significant impact on tourism [22]. Environmental hazards pose potential threats to tourism resources such as highlands, beaches, flora and fauna, cultural infrastructures and cause loss of cultural heritage and physical infrastructure. The natural environment is one of the key factors in determining tourists on their travel destination choice [23]. On the other hand, tourism leads to environmental hazards. Tourism sector will expand and build infrastructures such as restaurants, inns, and basic sanitation facilities which will then lead to greenhouse gas emission. Building material production is responsible for 7 percent of global carbon dioxide emissions, more than what comes from all the trucks in the world. Air pollution caused by tourism industry and transportation has an impact on the world, especially CO_2 emissions related to transportation energy usage. Thus, the third hypothesis is stated as below:

H3: There is a causality effect between environment hazard, international tourist arrivals and economic growth.

IV. METHODOLOGY

Following the study of Haiyan-Song *et al.* [24], the model specification in this research begins with a production function such that economic growth is associated to capital stock, labor force, and tourist arrivals, as shown below:

$$Y_t = f(K_t, L_t, T_t) \tag{1}$$

where Y_t is an aggregate output variable measured by gross domestic productivity; K_t is the capital input measured by capital formation at time t; L_t is the number employees as labor input at time t; and T_t is number of international tourist arrivals at time t. The monthly time series data that covers from January 2010 to March 2021 are gathered. Capital formation data, international tourist arrivals, and the number of employees is found from the CEIC DATA, Department of Statistics. In order to linearize the model, all of the time series data are transformed into natural logarithms.

In this study, historical temperature and sea level data at selected locations are gathered. A weather station captures the climate change trend in the main areas of Peninsular Malaysia and Borneo, Malaysia. In every major region of Malaysia, at least one station with comprehensive climate data is selected. Part of the weather stations are located in the cities Kota Kinabalu and Kuching to capture climate change in Sabah and Sarawak respectively. In Peninsular Malaysia, the selected sites are Malacca on the west coast, Kuantan on the east coast and Subang in the Federal Territory of Kuala Lumpur.

The model considered in this study can be defined as:

$$Y_{i,t} = \beta_0 + \beta_1 LnTA_{i,t} + \beta_2 Ln(TA*CO_{2i,t}) + \beta_3 Ln(TA*AQI_{i,t}) + \beta_4 Ln(TA*Climate\ Change_{i,t}) + \varepsilon_{i,t} \tag{2}$$

The dependent variable $Y_{i,t}$ is the gross domestic productivity of Malaysia for the period 2010–2020. The explanatory variables are defined as follows: *TA* is the international tourist arrivals in Malaysia; CO_2 is Carbon Dioxide Emissions, *AQI* is Air Quality Index, and climate change include temperature(*T*), humidity(*H*), pressure sea level(*SLP*), wind speed(*V*), storm(*TS*) and rain fall(*RF*). Temp is the average monthly temperature(°C); humidity is average relative humidity (%) in monthly; pressure sea level is atmospheric pressure at sea level (hPa); average monthly wind speed (Km/h); storm indicate total cases in a month; Rain Fall is total rain fall in mm. Climate data are collected in state of Malaysia such as Kuala Lumpur/Subang, Malacca, Kuantan, Kuching and Kota Kinabalu. The number of tourist arrivals is obtained from the CEIC DATA. The CO_2 and *AQI* data are obtained from OECD data. The climate change data is obtained from Tutiempo Network.

In this study, we utilize time-series techniques and econometrics models to measure the influence of international tourist arrivals and environmental hazards on Malaysian economic growth. Granger Causality Test is employed to test causality among the international tourist arrivals, environment risk and economic growth since these variables are co-integrated.

V. EMPIRICAL RESULTS

This study analyses the Tourism Led Economic Growth hypothesis employing regression-based models. International tourist arrival is the independent variable and GDP is the dependent variable. Parallel to previous studies, the international tourist arrival variable is statistically significant as international tourist arrivals contribute to GDP for all four selected lag period. In Table I, tourism has driven the economy with regression coefficient 1.861, 1.621, 1.423 and 1.301 respectively significant at 1 percent level. In other words, 1 percent rise in international tourist arrivals will increase economic growth by 1.861 percent, 1.621 percent, 1.423 percent and 1.301 percent respectively. Tourism activities have high degree of driving forces in the economic growth. The results suggest that tourism activities are important in promoting economic growth in term of increasing employment and revenue opportunities for local communities, along with assisting the overall economy by accumulating foreign currency reserves. The significant positive coefficient for labor force employment on GDP is also consistent with the expected sign. The increase of labor force employment leads to a higher economic growth in Malaysia. This shows that higher labor force employment is an absolute condition for economic growth in Malaysia.

TABLE I: EFFECTS OF TOURIST ARRIVALS, CAPITAL STOCK, LABOR FORCE EMPLOYMENT ON ECONOMIC GROWTH IN MALAYSIA

	Lag=0	Lag=1	Lag=2	Lag=3
Arrivals cause *Y*	1.861***	1.621***	1.423***	1.301***
K cause *Y*	0.671	0.498	0.133	-0.251
L cause *Y*	32.581***	36.282***	42.685***	45.705***
R-square	0.684	0.529	0.424	0.365
F-statistic	94.702	48.025	32.170	25.131
Observations	135	135	135	135

Note: Asterisks indicate significance at the **0.05 and ***0.01 levels, respectively.
Arrivals is international tourist arrivals. *Y* is real gross domestic productivity. *K* is Gross capital formation. *L* is labor force employment.

The second hypothesis proposes that an increase of environmental hazard moderated with international tourist arrivals leads to a lower Malaysian economic growth (GDP) such that strong (less) environment risk leads to lower (higher) economy growth. The result in Table II reveals that the greater air quality (AQI) estimates are consistent with the expected sign with a significantly positive coefficient for the GDP. This implies that an increase of international tourist arrivals under greater air quality condition leads to a higher economic growth in the selected five states in Malaysia. The regression coefficients of international tourist arrivals moderate with air quality on GDP are: 29.732 (AQI, Kuala Lumpur/Subang), 25.668 (AQI, Kuantan), 25.079 (AQI, Malacca), 22.753 (AQI, Kota Kinabalu) and 23.880 (AQI, Kuching) are statistically significant at 1 percent and 5 percent level respectively. Meanwhile, better air quality may attract more international tourist arrivals to Malaysia. Nevertheless, the result reveals that the pollutant (CO_2) shows a significant positive coefficient for the GDP with 9.818 (CO_2, Kuantan), 9.474 (CO_2, Malacca), 7.421 (CO_2, Kota Kinabalu) and 8.789 (CO_2, Kuching), respectively. This implies that an increase in the number of international tourist arrivals under with higher air pollutant leads to a higher economic growth. This suggests that air pollutant in Malaysia is not severe enough as to hinder international tourists to come to Malaysia. The effects of readiness on number of tourist arrivals in Malaysia fail to corroborate hypothesis *H2*,

which postulated the higher the readiness to climate change, the higher the number of tourist arrivals in Malaysia. However, the coefficient is insignificant. The impact of readiness on Malaysia gross domestic product reveals a positive relationship but it is also not significant. This result is aligned to hypothesis *H3*, which postulated the higher the readiness to climate change, the higher Malaysia gross domestic product.

TABLE II: EFFECT OF TOURIST ARRIVAL ON ECONOMIC GROWTH UNDER ENVIRONMENT HAZARD IN DIFFERENT STATES IN MALAYSIA

	Y				
	Climate change at Subang/ Kuala Lumpur	Climate change at *Kuantan*	Climate change at Malacca	Climate change at *Kota Kinabalu*	Climate change at *Kuching*
	Air Pollutant				
L(Arrivals *CO_2)	-0.707	9.818***	9.474**	7.421**	8.789***
	Air Quality				
L(Arrivals *AQI)	29.732***	25.668***	25.079***	22.753***	23.880**
	Climate				
L(Arrivals *Temperature)	-32.719***	-3.187	-10.064	-17.527***	-16.689***
L(Arrivals *Humidity)	-19.088***	-0.485	-7.753	-10.298***	-10.211***
L(Arrivals *Sea LevelPressure)	20.707*	-26.940***	-13.842	NIL	NIL
L(Arrivals *Wind Speed)	2.868**	-2.568**	-0.793	-0.296	-3.722*
(Arrivals* Storm)	1.546***	-1.41E-08	1.43E-08	1.67E-08	1.55E-08
Constant	-101.454**	57.488**	23.809	-23.071**	-27.261**
R-Squared	0.828	0.808	0.801	0.790	0.802
F-statistic	87.254	75.902	72.509	80.174	86.255
Observations	135	134	134	135	135

Note: The asterisks indicate significance at the *0.10, **0.05, and ***0.01 levels, respectively

Arrivals is international tourist arrivals. Y is real gross domestic productivity. *CO_2* is Carbon Dioxide. *AQI* is Air Quality Index.

The regression coefficient of international tourist arrivals moderated with temperature on GDP is -32.719 (Kuala Lumpur/Subang), -17.527 (Kota Kinabalu) and -16.689 (Kuching) is statistically significant at 1 percent level. The regression coefficient of international tourist arrivals moderated with humidity on GDP is -19.088 (Kuala Lumpur/Subang), -10.298 (Kota Kinabalu) and -10.211 (Kuching) is statistically significant at 1 percent level. The result implies that an increase in the number of international tourist arrivals with a rise in temperature and humidity leads to a lower economic growth for all five states in Malaysia. Higher temperature and humidity may expel tourists from Malaysia and they may shift their tourism destination. Besides that, the result in Table II shows that sea level and wind speed on GDP in Kuantan are -26.940 and -2.568 respectively, which are consistent with the expected sign. This implies that an increase in the number of international tourist arrivals under higher sea level pressure and wind speed leads to a lower economic growth in the Kuantan, Malaysia. The result is not surprising since higher sea level pressure and wind speed affect tourist activities in Kuantan and beach areas, in which activities such as surfing, walking trails fronting the coastline, seafood quality, breeding colony of turtles, snorkelling, fishing trips and sea kayaks will be disrupted.

The third hypothesis proposes that there is a granger causality between the selected variables. The results of the Granger causality test for investigating the link between GDP and tourist arrivals, CO_2 and tourist arrivals, AQI and tourist arrivals, temperature and tourist arrivals, humidity and tourist arrivals, sea level pressure and tourist arrivals, wind speed and tourist arrivals, rain fall and tourist arrivals are shown in Table III. The result indicates a bidirectional relationship between temperature and international tourist arrivals in Kuantan and Malacca states, while there is no evidence of a causal relationship between these variables in Kuala Lumpur/Subang and Borneo in Malaysia. Similarly, the result shows a bidirectional relationship between total monthly storm and international tourist arrivals in all selected states in Malaysia. These findings suggest that tourism and storm indicators drive each other. Besides that, the result reveals a unidirectional causality that runs between international tourist arrivals and variable GDP, CO_2, AQI and rainfall, respectively in the selected five states in Malaysia. This implies that national income, CO_2 emission, air quality and rainfall significantly affect foreign tourist flow to Malaysia.

TABLE III: GRANGER CAUSALITY TEST BETWEEN TOURIST ARRIVAL, ECONOMIC GROWTH AND ENVIRONMENT HAZARD

Null Hypothesis	Kuala Lumpur/ Subang	Kuantan	Malacca	Kota Kinabalu	Kuching
Granger causality F test statistics					
Arrivals does not cause Y			0.793		
Y does not cause Arrivals			14.771***		
Arrivals does not cause CO_2			0.677		
CO_2 does not cause Arrivals			5.000***		
Arrivals does not cause AQI			1.013		
AQI does not cause Arrivals			9.703***		
Arrivals does not cause Temperature	1.4283	2.254*	2.520*	0.129	1.654
Temperature does not cause Arrivals	0.854	2.107*	2.040*	0.332	0.403
Arrivals does not cause Humidity	2.670**	0.679	2.035*	8.307***	5.229
Humidity does not cause Arrivals	1.888*	0.025	3.759***	0.747	0.963
Arrivals does not cause SeaLevelPressure	2.310*	2.897**	2.208	NIL	NIL
SeaLevelPressure does not cause Arrivals	6.705***	3.720***	7.078***	NIL	NIL
Arrivals does not cause WindSpeed	0.948	2.532**	4.142***	0.486	3.260***
WindSpeed does not cause Arrivals	1.123	4.037***	2.089**	3.598***	2.476**
Arrivals does not cause Storm	2.602**	4.128***	2.259*	3.738***	2.135*
Storm does not cause Arrivals	2.056*	3.919***	5.567***	4.744***	4.471***
Arrivals does not cause RainFall	0.769	0.731	8.119***	1.762	0.000
RainFall does not cause Arrivals	3.911**	4.509**	0.900	1.994*	2.308*
Observation	133	133	133	133	133

Asterisks indicate significance at the **0.05 and ***0.01 levels, respectively.

Arrivals is international tourist arrivals. Y is real gross domestic productivity. *CO_2* is Carbon Dioxide. *AQI* is Air Quality Index.

Overall, the Granger causality test results indicate Malaysian economic growth and environmental hazards, such as carbon dioxide emission (CO_2) and air quality index (AQI) significantly influence the flow of international tourist arrivals. Nevertheless, international tourist arrival variable shows no significant cause to GDP, CO_2 and AQI variables. Tourism industry does not significantly impact the nation

environment.

VI. Conclusion

This study utilizes an econometric model to examine how international tourist arrivals impact on economic growth under environmental hazards in selected five states in Malaysia. This study also analyze the granger causality between international tourist arrivals, economic growth and environmental hazards. The results demonstrate that environmental hazard plays a dominant role in negatively influencing international tourism arrivals and thus affects economic growth in Malaysia. The results also reveal that there is a causality relationship between international tourist arrivals, environmental hazard and Malaysian economic growth.

Unfortunately, limited pollutant data are only available in Malaysia. Other air pollutants variables, such as Tropomi Nitrogen Dioxide Density, radiation, four atmospheric pollutants (PM2.5, PM10, SO_2, and NO_2), CO (carbon monoxide) and O3 (ozone), are not included in this study due to the unavailability of data. If more data can be collected in future, the impact of other air pollutants can be further investigated.

Specific actions that can be implemented in the short term are improving energy and water efficiency, reducing the consumption of water and energy, reusing renewable energy sources, minimizing wastes, recycling and restricting access into endangered areas.

Appendix

TABLE A: Akaike Information Criterion for Detect the Maximum Lag Selection for Granger Causality F Test Statistics

	Lag=1	Lag=2	Lag=3	Lag=4	Lag=5	Lag=6
TA PAIR WITH *Y*	30.516	30.232	30.167	30.071	**30.056**	30.100
TA PAIR WITH *CO₂*	23.298	**21.794**	21.820	21.884	21.941	21.985
TA PAIR WITH *AQI*	27.464	**26.689**	26.720	26.714	26.755	26.800
Kuala Lumpur/ Subang						
TA PAIR WITH *T*	29.389	29.408	29.387	29.398	**29.307**	29.344
TA PAIR WITH *H*	32.826	32.830	32.820	**32.743**	32.773	32.807
TA PAIR WITH *SLP*	29.592	**29.555**	29.596	29.602	29.583	29.654
TA PAIR WITH *V*	29.396	29.421	29.374	29.429	**29.361**	29.382
TA PAIR WITH *TS*	33.725	33.713	33.609	**33.582**	33.624	33.604
TA PAIR WITH *RF*	**39.867**	39.922	39.923	39.954	39.920	39.940
Kuantan						
TA PAIR WITH *T*	29.416	29.251	**29.159**	29.188	29.206	29.228
TA PAIR WITH *H*	**39.602**	39.631	39.677	39.730	39.775	39.824
TA PAIR WITH *SLP*	30.027	30.032	29.990	**30.021**	30.030	30.059
TA PAIR WITH *V*	30.110	29.974	29.826	29.866	29.893	**29.775**
TA PAIR WITH *TS*	33.854	33.740	33.724	33.701	33.731	**33.581**
TA PAIR WITH *RF*	**41.237**	41.266	41.296	41.321	41.381	41.405
Malacca						
TA PAIR WITH *T*	29.131	**29.080**	29.081	29.121	29.169	29.219
TA PAIR WITH *H*	32.468	32.482	32.493	**32.452**	32.521	32.466
TA PAIR WITH *SLP*	29.653	**29.642**	29.665	29.681	29.666	29.730
TA PAIR WITH *V*	31.217	31.133	31.028	31.076	31.084	**31.019**
TA PAIR WITH *TS*	33.760	33.669	33.673	**33.660**	33.696	33.700
TA PAIR WITH *RF*	**39.383**	39.399	39.391	39.418	39.471	39.490
Kota Kinabalu						
TA PAIR WITH *T*	**29.133**	29.168	29.188	29.242	29.273	29.302
TA PAIR WITH *H*	**32.231**	32.242	32.242	32.262	32.287	32.280
TA PAIR WITH *SLP*	NIL	NIL	NIL	NIL	NIL	NIL
TA PAIR WITH *V*	29.461	29.411	29.391	29.369	29.382	**29.331**
TA PAIR WITH *TS*	33.741	33.655	33.606	**33.548**	33.590	33.583
TA PAIR WITH *RF*	40.278	40.271	40.265	**40.260**	40.297	40.282
Kuching						
TA PAIR WITH *T*	**29.083**	29.104	29.142	29.173	29.176	29.176
TA PAIR WITH *H*	**31.864**	31.900	31.923	31.950	31.979	31.940
TA PAIR WITH *SLP*	NIL	NIL	NIL	NIL	NIL	NIL
TA PAIR WITH *V*	28.934	28.962	28.924	28.827	**28.807**	28.822
TA PAIR WITH *TS*	33.201	33.150	33.101	**33.096**	33.141	33.136
TA PAIR WITH *RF*	**40.760**	40.798	40.821	40.886	40.873	40.892
Observation	132	132	132	132	132	132

Y is the gross domestic productivity of Malaysia. *TA* is the international tourist arrivals in Malaysia; *K* is the capital input measured by capital formation; *L* is the number employees as labor input; CO_2 is Carbon Dioxide Emissions, *AQI* is Air Quality Index, and *T* is temperature, *H* is humidity, *SLP* pressure sea level, *V* is wind speed, *TS* is thunderstorm and *RF* is rain fall.

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