

ARIMA-INTERVENTION MODEL: DEMAND OF TOURISM IN MALAYSIA

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Abstract. Malaysia is a paradise for tourists because of its natural and cultural advantages. The tourism sector plays an important role in Malaysia, not only generating national income but also influencing other economic indicators. Malaysia introduced the Goods and Services Tax (GST) on 1 April 2015 and the Tourism Tax (TTx) on 1 September 2017. This study aims to investigate the impact of the tax system, such as GST and TTx, on the demand for tourism in Malaysia. We used monthly tourist arrivals data as a proxy for the demand for tourism. Additionally, we adopted ARIMA-Intervention analysis to regress the monthly data from January 2014 to December 2018. The findings prove that GST has a significant negative impact on the demand for tourism at 5%, while TTx has a negative impact on the demand for tourism at 10%. This study provides valuable insight into the impact of tax system implementation on tourism demand. Thus, the government should revise the impact of tax policy on the tourism sector before implementation, particularly regarding the decision to resume GST or introduce any tourism-related tax. This action is vital to ensure that the growth of the tourism sector supports the sustainability of national economic growth.

Keywords: *tourism demand, intervention analysis, GST, tourism tax, Malaysia*

Introduction

Malaysia is a country located in South East Asia. Malaysia comprises the Peninsular which consists of 11 states, Sabah and Sarawak. Malaysia is surrounded with 5 seas which are the South China Sea, Straits of Malacca, Straits of Johor, Sulu Sea and the Celebes Sea. Hence, there are many famous Island which are the Langkawi Island, Tioman Island, Pangkor Island and Perhentian Island in Malaysia. Besides the island and beach, Malaysia also consists of the mountains and the highlands which suitable for tourism such as the Kinabalu mountain, Tahan mountain, Genting Highlands and the Cameron Highlands. The climate in Malaysia is the equatorial which is hot and humid in the whole year. Therefore, Malaysia is the paradise of tourism because of the geographic and climate advantages. Besides the natural advantages, the citizens of Malaysia have a variety of culture because the citizens of Malaysia is comprised by different races such as the Malays, Chinese, Indians, Ibans, Kadazan, and others. Hence, the culture varies from the festival, food, traditional clothes and dance which will be the attraction to the foreign tourists to come to visit Malaysia (Planet et al., 2019). The tourism sector plays an important role to stimulate the Malaysia economy. From *Table 1*, the contribution of the tourist receipt to the Gross Domestic Product (GDP) exceeds 5% within these nine years recently from 2010 to 2018. Hence, the tourist not only will generate our national income but also will promote the growth of other sectors that

relate to tourism including the hotel industry, transportation industry and the food and beverage industry. Moreover, the growth in tourism will create the job opportunity in the local market which will directly reduce the unemployment rate of the country.

Table 1. Tourist receipt and gross domestic product in Malaysia.

Year	Tourist receipt (RM million)	Gross domestic product (RM million)	Contribution of receipt to GDP (%)
2010	56,492.5	821,434	6.87
2011	58,315.9	911,733	6.39
2012	60,556.7	971,252	6.23
2013	65,443.3	1,018,614	6.42
2014	71,998.8	1,106,443	6.50
2015	69,119.6	1,176,941	5.87
2016	82,098.2	1,249,698	6.56
2017	82,165.0	1,317,027	6.23
2018	84,135.2	1,395,528	6.02

According to the Malaysia Tourism Key Performance Indicator Report 2018, the total number of tourist arrivals is 25,832,354 people. From that amount, the top arrivals to Malaysia in 2018 is from Singapore (10,615,986 people) and followed by Indonesia (3,277,689 people), China (2,944,133 people), Thailand (1,914,692 people) and Brunei (1,482,031 people). Hence, besides the neighbour countries from South-East Asia, China tourist is contributed the most among the arrivals. Among the arrivals, 55.3% is for holiday, 19.8% for visiting friends and relatives, 13.4% for shopping, 3.7% for health treatment, 2.4% for business, 1.4% for meetings, events and incentive travel (M.I.C.E), 0.6% for honeymoon and 0.6% for education. From *Figure 1*, the tourist arrivals are increasing from 2010 to 2014 which is from 24,577,196 people increased to 27,437,315 people. The increment is 2,860,119 people or 11.63%. However, the number of arrivals is decreased in 2015 to 25,721,251 people because of the haze issue which gives an impact on the tourism sector in Malaysia. After that, the number of arrivals increased to 26,757,392 people during 2016 and face an unstable trend which is up and down trend during 2017 and 2018.

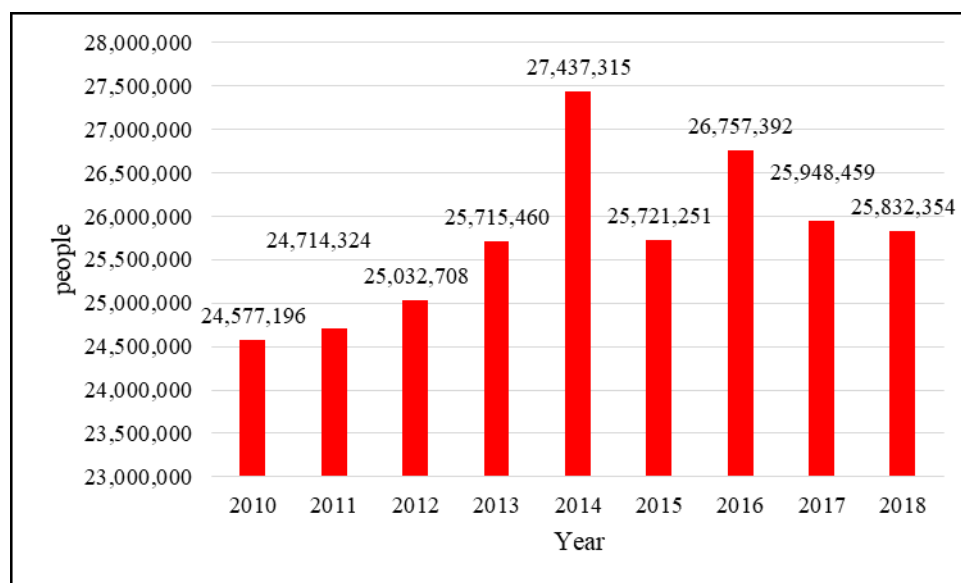


Figure 1. Tourist arrivals in Malaysia.

Good and service tax (GST) is a broad-based consumption tax introduced by the Malaysia government since 1 April 2015 with 6% of the tax rate. The GST with a standard rate is charged to the supplier who supplies the goods and services. After that, the GST is collected by the business and paid back to the government. Then, the supplier can recover credit back on their input. However, the GST system is abolished and replaced with the sales and service tax (SST) when the changes of the Pakatan Harapan government in Malaysia. On the other hand, the tourism tax (TTx) which a lump-sum RM 10 per room per night will be charged to the foreign tourist who staying at any accommodation premises in Malaysia since 1 September 2017 (Joibi, 2017). Besides that, this TTx is remained by the Pakatan Harapan government until today. Hence, the implementation of the tax will increase the cost of the tourist when visiting Malaysia because the tax will increase the price of the goods and services. Their decision to Malaysia maybe will be influenced because of the increase in the cost and change their destination to a more affordable country. The objective of this paper is to identify the impact of the GST and the TTx on demand of tourism by using the ARIMA-intervention model. The significance of the impact of the GST and the TTx to the demand of tourism is examined. Therefore, the government can revise the tax policy so that the demand of tourism will not affected and kept increasing each of the years.

Review of literature

There were many studies investigating the impact of a crisis on tourism demand via the intervention analysis. Notably, financial crisis, public health crisis, or political crisis or instability. In term of the financial crisis, Song et al. (2003) modelled the demand for Thai tourism by seven countries which involve Australia, Japan, Korea, Singapore, Malaysia, the United Kingdom and the United States of America by using the general autoregressive distributed lag model (ARDL). They used the Asian financial crisis as the dummy for the intervention analysis and the result shown that the Asian financial crisis had a significant impact on tourist arrivals which from Malaysia, Korea, United Kingdom and Singapore. A research done by the Lee et al. (2010a) described the impact of the Asian financial crisis on tourist arrivals to Indonesia. The intervention model is used while the monthly data which is the number of tourist arrivals in Indonesia through Soekarno-Hatta airport from January 1989 to December 2009 is used for estimation. Haque and Haque (2018) stated that the impacts of the swine flu and global financial crisis 2008 towards the tourism in Brunei. The ARIMA intervention analysis is used and the result showed that the global financial crisis had a significant reduction in the number of tourists.

Next, the discussion was turned into public health crisis. Min et al. (2010) described the impact of the Severe Acute Respiratory Syndrome (SARS) on Japanese tourism demand for Taiwan. They used the SARIMA with an intervention model and found that the SARS has a significant impact on the tourism demand lasted for about a year. Besides that, Goh and Law (2002) in their study using the SARIMA and MARIMA with interventions of bird flu epidemic in modelling the tourism demand by using the arrival series in Hong Kong. Haque and Haque (2018) not only utilized the financial crisis as the intervention variable in their study, they also used the swine flu and also expressed negative impact on the tourist demand. Recent studies had used the COVID-19 pandemic as the intervention variables in investigating the tourist demand. For instance, Rianda and Usman (2023), who had used the ARIMAX intervention model, claimed that the COVID-19 pandemic had reducing the international visitors who

visited Indonesia. From their intervention analysis, they proved that Indonesia lost 90 per cent of international tourist since April 2020. In the same county, Rahayu and Sumargo (2023) adopted the intervention analysis and ARCH to modelling the impact of COVID-19 pandemic on the number of foreign tourists. Same negative impact also found by them in their study, and also supported by Paudel et al. (2024), who modelling the impact of COVID-19 pandemic on tourist demand in Nepal. They applied the data from January 1992 to December 2023 and emphasised that COVID-19 pandemic had reduced on the tourist demand significantly.

Regarding to the political crisis or instability, several studies had made this analysis, such as in Indonesia (Lee et al., 2010b), in EU countries (Smeral and Wüger, 2008), in South Korea (Seong and Lee, 2021), and in Thailand (Praprom and Laipaporn, 2021). The incidents were including terrorist attacks, 9/11 effect on U.S. airlines, and political unrests. Seong and Lee (2021) described that the negative impact from 9/11 effect on U.S. airlines on tourism demand in South Korea while Praprom and Laipaporn (2021) applied SARIMA model with intervention model denoted that political unrests in Thailand significantly affected the number of arrivals, especially tourists from Malaysia. Smeral and Wüger (2008) claimed that their study using the ARIMA-intervention model to investigate the effect of organizing an EU presidency on the tourism of a country. Besides that, some studies had investigated the impact of tax policy or tourism-related policy on tourism demand. An ARIMA-intervention analysis used by Bonham and Gangnes (1996) to evaluate the room tax impact on the hotel revenues in Hawaii by using the data 1987. Meanwhile, the result revealed that the impact did not have a significant permanent impact on the revenue. Lee et al. (2010a) applied the ARIMA intervention to identify the impact of the visa-free entry on tourism demand between Japan and South Korea. Their results from the ARIMA intervention analysis shown that the influence of the change to visa-free entry achieves more than 20 percent to the demand for the tourism demand of South Korean to Japan. Meanwhile, Bonham et al. (1992) described the impact of the hotel room taxes on the demand for travel and vacation goods in Hawaii. They used the interrupted time series analysis which is ARIMA intervention to estimate the impact and the analysis before the tax and after the tax toward the revenue of the hotel as the proxy to the demand of the tourism. As a result, this study intends to investigate the impact of tax policy on tourism demand in Malaysia by using the ARIMA-intervention analysis.

Materials and Methods

Data

The data which the total number of tourist arrivals as proxy to the demand of the tourism is used. The monthly tourist arrivals to Malaysia from January 2014 to December 2018 acquired from the Ministry of Tourism, Arts and Culture Malaysia.

Intervention model approach

The model which examines the impact of events can be used in the intervention analysis (Box and Tao, 1975). Before the intervention, the ARIMA model is applied to test the effects of an exogenous intervention upon the level of time series. Different intervention model can be formed for this content. The level of preintervention series is compared with the level of the time series which followed the intervention. The

significance of the intervention also is computed to measure the importance of the impact of the events on the dependent variable. Hence, this paper will use the intervention analysis which the impact of the GST and the TTx to the demand for tourism in Malaysia is examined. After the characteristics of the series itself, the demand comparison is performed. Besides that, the noise also had been considered into the model so that the results of the comparison is most valid. The model of the intervention analysis can be written as in Eq. (1):

$$Y_t = f(I_{1t}, I_{2t}) + N_t \quad \text{Eq. (1)}$$

Where; Y_t =The number of the tourist arrivals; I_{1t} =The intervention of GST; I_{2t} =The intervention of TTx; and N_t =Noise component.

The ARIMA model

The ARIMA models which AR is the autoregressive, I is the integrated and the MA is the moving average (Box et al., 2015). The AR(p) and MA(q) model which the p and q in bracket represented that the number of lagged dependent variables of the model. The AR(p) model as following Eq. (2):

$$Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \dots + \phi_p Y_{t-p} + u_t \quad \text{Eq. (2)}$$

Meanwhile, the MA(q) model as following Eq. (3):

$$Y_t = u_t + \theta_1 u_{t-1} + \phi_2 u_{t-2} + \dots + \phi_q u_{t-1-q} \quad \text{Eq. (3)}$$

After that, ARMA (p,q) models is generated from the combinations of the two processes which can be shown by Eq. (4):

$$Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \dots + \phi_p Y_{t-p} + u_t + \theta_1 u_{t-1} + \phi_2 u_{t-2} + \dots + \phi_q u_{t-1-q} \quad \text{Eq. (4)}$$

Next, the data is proceed with undergoes the process of Box-Jenkins methodology. The Box-Jenkins procedure is divided into three stages, which are the identification process, estimation process, and diagnostic process. In the identification stage, the initial task is to assess the stationarity of the model. This paper will conduct the stationarity test using the Augmented Dickey-Fuller (ADF) test to determine whether the model exhibits a “unit root” issue. A P-value of less than 5% indicates that the model does not have a “unit root” problem, leading to the rejection of the null hypothesis and suggesting that the model is stationary over time. Conversely, if the P-value is greater than 5%, it suggests that a “unit root” problem exists, the null hypothesis cannot be rejected, and the model is not stationary. Therefore, it is necessary to apply logarithmic transformations or first differences to the model and subsequently perform the unit root test again to verify its stationarity (Ng et al., 2023). Once stationarity is achieved, the next step involves identifying the p and q orders of the ARIMA model using the correlogram (*Figure 2*). This entails detecting significant spikes in the ACF for the AR component or PACF for the MA component. After determining the number of lags for the ARMA (p,q) model, multiple models are

estimated to identify the most suitable one during the diagnostic phase. The Akaike information criterion (AIC) and the Schwartz Bayesian criterion (SBC) will be utilized to evaluate the estimated results. The model with the lowest AIC and SBC will be chosen as the most appropriate. Furthermore, the goodness of fit will be assessed (Asteriou and Hall, 2021). The final model will undergo another round of diagnostic checking to confirm that all spikes fall within the limits of stationarity for both the AR and MA coefficients.

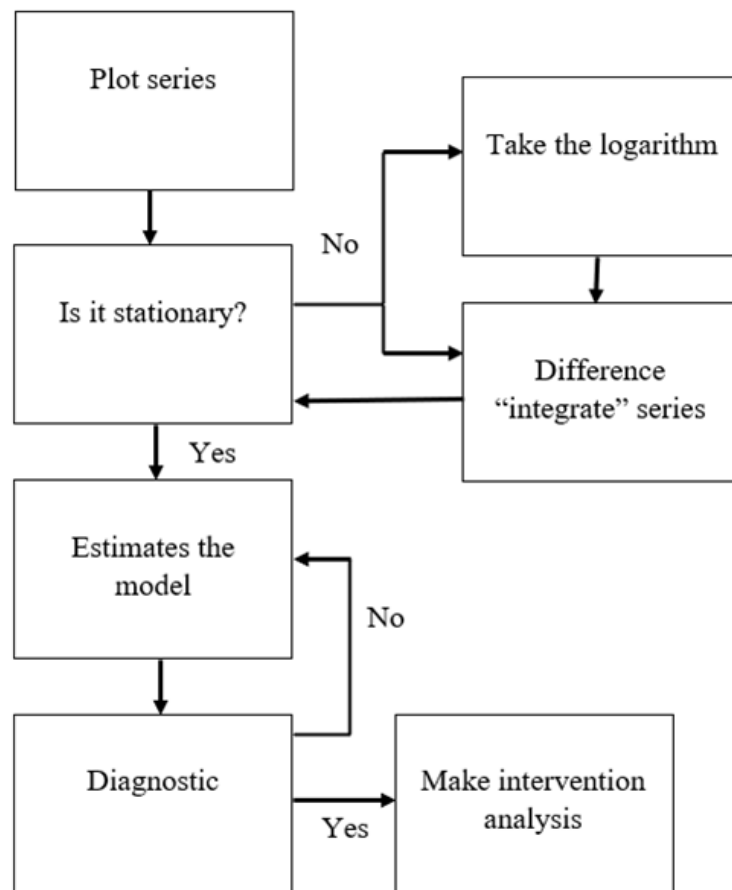


Figure 2. Procedure of ARIMA-intervention analysis.

Results and Discussion

Stationary test

The stationary test is applied by using the Augmented Dickey-Fuller test. The null hypothesis (H_0) in which the model is non-stationary while the alternative hypothesis (H_a) is the model have stationary. *Table 2* shows that the results of the Augmented Dickey-Fuller test which the tourist arrivals are stationary in the level either the intercept or the trend and intercept. Hence, the tourist arrivals in the level ($I=0$) is used for the correlogram to find out the $AR(p)$ and $MA(q)$.

Table 2. The results of Augmented Dickey-Fuller test.

Variable	Level
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	Intercept	Trend and intercept
Tourist Arrivals (TA)	-7.793***	-5.452***

Note: ***, ** and * show the significance level at 1%, 5%, and 10%.

Correlogram

From *Figure 3*, the correlogram shown that the spike of autocorrelation (ACF) is exceeds the bounds at the twelfth lags while the spike of the partial autocorrelation (PACF) is exceeds the bounds at the tenth lags and twelfth lags.

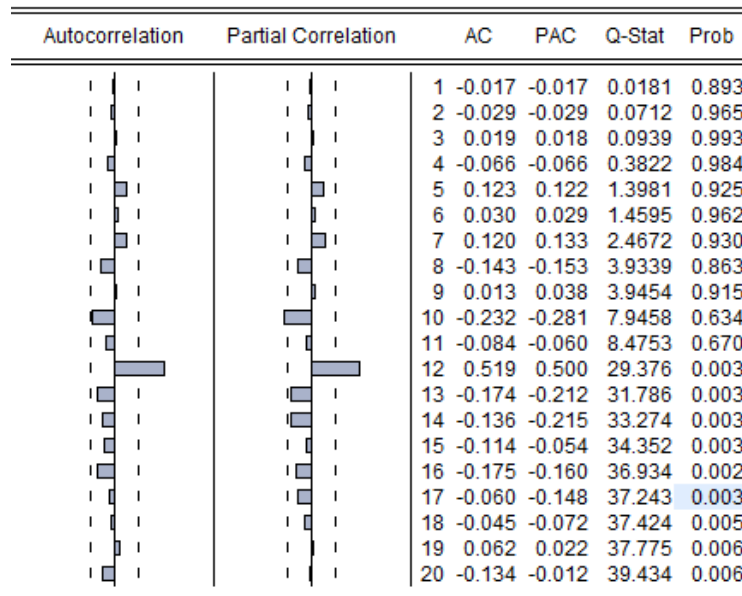


Figure 3. Correlogram 1.

Estimation and diagnostic

The estimation is proceeding with the AR(p) and MA(q) which identified from the correlogram. The models which can be formed are model AR(12), MA(10), model AR(12), MA(12) and model AR(12), MA(10) and MA(12) (*Table 3*). Through the result of the estimation, the model of ARIMA with AR(12), MA(10) and MA(12) is the most adequate model because of the model have the most number of the significant variables (3), the highest adjusted R² (0.5325), the lowest Akaike Info Criterion (26.3285) and the lowest of Schwarz Criterion (26.5030) if compared to other models (*Table 4*). The adequate model undergoes the correlogram again to ensure that there is no more spike to exceed the bound of ACF and PACF. The result from *Figure 4* shows that all spike is within the bound for the model ARIMA AR(12), MA(10) and MA(12).

Table 3. The estimation result.

Measurement	ARIMA (p,q)		
	AR(12), MA(10)	AR(12), MA(12)	AR(12), MA(10), MA(12)
Number of significant variable	2	1	3
Adjusted R ²	0.4188	0.4567	0.5325
Akaike Info Criterion	26.3988	26.3891	26.3285
Schwarz Criterion	26.5385	26.5287	26.5030

Table 4. The estimation result, AR(12), MA(10) and MA(12).

Variable	Coefficient	Standard error	T-statistic	Probability
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C	2195509	12461.23	176.1872	0.0000
AR (12)	0.9403	0.0840	11.1952	0.0000
MA (10)	-0.3452	0.1430	-2.4131	0.0192
MA (12)	-0.6549	0.2953	-2.2179	0.0307
SIGMASQ	1.06E+10	3.48E+09	3.0366	0.0037

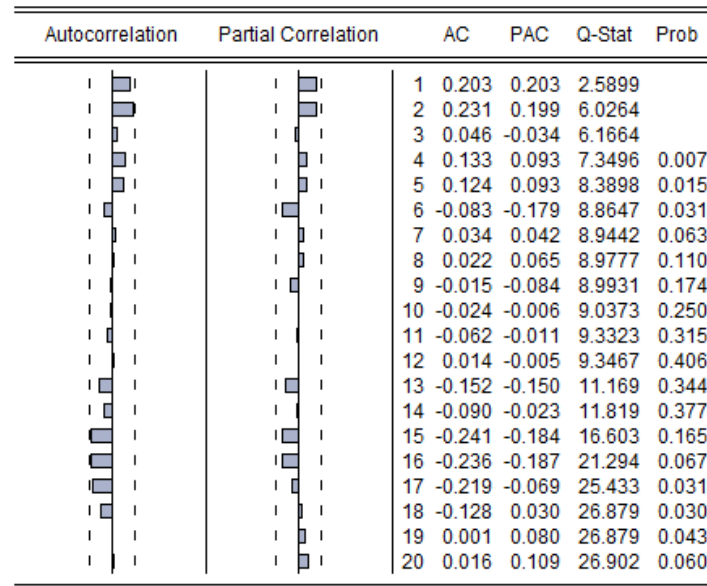


Figure 4. Correlogram 2.

The intervention analysis

The ARIMA model undergoes the intervention analysis by adding the dummy variable which including the Goods and Services Tax (GST) and the Tourism Tax (TTx). The preintervention tourist arrivals are 2,259,967 people. From Table 5, the implementation of GST will reduce the number of tourist arrivals by 73,070 people while the implementation of the TTx will reduce the number of tourist arrivals by 66,995 people. The negative impact of the GST toward the demand of tourism in Malaysia is significant at the 5% level. However, the negative impact of the TTx toward the demand for tourism in Malaysia is significant at the 10% level.

Table 5. Result of intervention analysis with GST and TTx.

Variable	Coefficient	Standard error	T-statistic	Probability
C	2259967	24604.14	91.8531	0.0000
GST	-73070.52	29829.43	-2.4496	0.0176
TTX	-66995.23	36014.64	-1.8602	0.0684
AR(12)	0.9418	0.0702	13.4169	0.0000
MA(10)	-0.3508	0.1347	-2.6041	0.0119
MA(12)	-0.6492	0.3055	-2.1246	0.0383
SIGMASQ	8.49E+09	2.90E+09	2.9289	0.0050

Conclusion

In conclusion, the objective of this paper is to examine the impact of the GST and the TTx towards the demand of tourism in Malaysia. Tourism is an important sector in

Malaysia not only generates national income but also will influence other economic indicators such as the unemployment rate. The ARIMA-intervention analysis is very effective to measure the impact of the policy toward the dependent variables. From the result of the intervention analysis, the GST policy and the TTx policy have a negative impact on the demand for tourism in Malaysia. Besides that, the impact of GST is significant at 5% level. If the government of Malaysia has the intention to resume back the GST policy, then the tourism sector will be affected. Meanwhile, the government needs to revise back the TTx so that this can attract more tourist comes to Malaysia after the infection of the Corona-19 Virus.

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Conflict of interest

The authors confirm that there is no conflict of interest involve with any parties in this research study.

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