THE IMPACT OF INTERNATIONAL TOURIST ARRIVALS ON ECONOMIC GROWTH UNDER DENGUE FEVER RISK IN MALAYSIA

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ABSTRACT

Dengue fever has long been a community health problem in tropical countries. Dengue virus is a crucial cause of disease in international tourists, with a rising number of them returning from dengue-endemic countries infected with dengue fever. This study analyses the impact of international tourist arrivals on economic growth moderated by dengue fever cases in Malaysia from 2014 until 2020. This study was carried out using secondary monthly data for dengue fever cases, gross domestic product (GDP), and international tourist arrivals. A correlation test was used to analyse the correlation between the independent, dependent and moderating variables. Granger causality test was employed to determine the causality between the selected three variables, dengue fever cases, international tourist arrivals, and economic growth. The results reveal a significant correlation between dengue fever cases, tourist arrivals, and economic growth. Between 2017 and 2018, higher international tourist arrivals led to lower economic growth under dengue disease hazards in Malaysia. Furthermore, dengue fever risk is found to have a positive relationship with international tourist arrivals and vice versa. The findings show a causality effect between the selected variables. The selected three indicators drive each other in the period study. In line with the government's strategy to promote the Malaysian tourism industry, prevention and recovery policies should be planned considering the number of dengue cases and economic factors.

Keywords: International tourist arrivals, economic growth, dengue fever, Malaysia.

INTRODUCTION

Since the early 1950s, dengue fever has become a crucial community health issue of concern worldwide (Ayala & Estrugo, 2014; Cheong et al., 2013). In particular, dengue fever is rapidly spreading in subtropical and tropical countries. It is a disease caused by mosquito-borne infections triggered by four different serotypes, which are DEN-1, DEN-2, DEN-3, and DEN-4. They are members to genus Flavivirus, family Flaviviridae. Dengue virus is mainly spread by Aedes

albopictus and Aedes aegypti. Before the 1970s, only nine countries were affected by the dengue fever endemic, but more than one hundred are currently affected (Arima, 2012).

In Malaysia, dengue infection is one of the most prevalent public health problems (Holmes et al., 2009; Poovaneswari, 1993). Dengue disease is transmitted throughout Malaysia. The Ministry of Health Malaysia Report (2021) indicates a series of dengue fever cases outbreaks: 3,006 cases and 35 deaths recorded in 1982; 13,0385 cases and 182 deaths in 2019, and 84,688 cases and 118 deaths in 2020. Disease-carrying mosquitoes cause approximately 1 million deaths each year.

In 1902, the first dengue fever that broke out was reported to have taken place in Penang, Malaysia, with 41 cases and five deaths (Skae, 1902). It later spread all over the country (Poovaneswari, 1993). Later, a series of outbreaks were reported in 1973 involving 1,487 cases with 54 deaths, 2,200 cases and 104 deaths in 1974, and 3,006 cases in 1982 involving 35 deaths (Cheong et al., 2014; Ministry of Health Malaysia Report, 2012). Since the 1980s, a change in age patterns among those who are infected has been reported, ranging from children to young people. In 2009, 13,0385 dengue fever cases were reported (Ministry of Health Malaysia Report, 2021). Dengue fever substantially affects citizens' livelihood, with a 60 percent drop in quality of life (Lum et al., 2008). Malaysia is experiencing a very serious problem of vector-borne diseases, particularly dengue fever, caused by Aedes mosquitoes. The population of Aedes mosquitos has multiplied due to the fluctuating rainfall patterns and the heat of tropical regions (Li et al., 1985; Morin et al., 2013).

Patients infected with dengue virus (DENV1, DENV2, DENV3, or DENV4) from these mosquitoes will develop symptoms such as fever, joint pain, myalgia, rash, and headache (Malaysian Ministry of Health, 2015; World Health Organization, 2009). Most of them would recover within a few weeks after the infection. Despite this, the patient is in danger of developing more complicated symptoms like Dengue Shock Syndrome, which could lead to severe plasma leakage, multiple organ dysfunctions, and bleeding manifestations. Each year, 500,000 severe cases of dengue fever are estimated, resulting in 12,500 deaths.

Chikungunya fever (a viral illness transmitted by mosquitoes) is another public health concern in subtropical and tropical areas, particularly in Asia and the American continent. Chikungunya fever infected about 33 percent of the population of Reunion Island in France between 2005 and 2006 (Reiter et al., 2006). Meanwhile, India had 1,500,000 suspicious cases between 2006 and 2008 (Prajapati & Singh, 2008). The World Health Organization (2006) reported that dengue fever is the fastest spreading mosquito-borne disease worldwide. Hence, the dengue fever endemic puts more than one hundred countries in danger (Beatty et al., 2007).

International tourists returning from dengue-endemic countries could potentially increase the number of dengue fever cases. Wen et al. (2005) discovered that severe acute respiratory syndrome (SARs) negatively influenced tourists' inherent motivation to travel as potential tourists are less willing to travel during an epidemic or pandemic. After the bird flu outbreak, the number of people arriving in Asia-Pacific decreased by 12 million (Wilder-Smith, 2006). Furthermore, a negative and significant relationship between travel-related diseases (TRD) risk and international tourist arrivals were found. Countries at risk of TRD received international fever tourists (Jaume Rosello et al., 2017). Between 22 and 64 percent of travellers reported health problems when visiting developing countries. Communicable diseases are often the most apparent health hazard for possible travellers (Steffen et al., 2003). Infectious diseases harm the tourism industry. Tourists concerned with the risk of contracting infectious diseases are reluctant to travel to destinations that may endanger their lives (Jonas et al., 2011). Tourists are prone to avoid high-risk destinations (Carter, 1998). Tourists' travel plans will include the recognised threat of infectious diseases like dengue fever.

Researchers have explored the impact of specific endemic diseases on tourism. Dileep et al. (2019) investigated the influence of dengue fever and chikungunya on tourism income in India. A 4

percent reduction in international tourist arrivals caused a huge loss of revenue in the tourism industry, and Malaysia also lost at least USD65 million (Dileep et al., 2019). The direct cost per year of dengue fever and chikungunya to the economy is estimated at USD133 million in Malaysia. Blake et al. (2003) found that tourism expenditures in the United Kingdom were greatly reduced by other types of diseases, such as the outbreak of foot and mouth disease. Kuo et al. (2008) found that contagious diseases, such as avian influenza and acute respiratory syndrome, affected foreign tourists in Asian countries. In addition, McAleer et al. (2010) found that the impact of SARS on international tourists to Asia was more severe than bird flu. The findings suggest that diseases hurt foreign arrivals in Asian countries. Previous studies found that infectious diseases harmed the tourism industry and economic growth in countries or regions.

Tourism contributes positively to economic development through higher revenues and employment. The tourist expenditure and incomes are utilised to finance the tourism sector and further spur Malaysia's economic growth. Tourism development also contributes indirectly to economic growth in terms of infrastructure investment and human capital development. Archer (1995) argues that tourism growth increases gross savings, generates employment opportunities, and improves the countries' balance of payments.

Empirical studies on the impact of foreign tourist arrivals on economic growth are quite limited. To our knowledge, the study of the impact of foreign arrivals on GDP under a dengue disease condition is non-existent despite 130,385 and 84,688 dengue fever cases reported in 2019 and 2020, respectively. Scientists have announced that the Malaysian temperature will increase between 1.1°C and 3.6°C in the next 100 years, and the threat of dengue fever increases with a heat increase of 1 degree Celsius (°C) (Gagnon et al. 2001). Mordecai et al. (2017) found that rising temperatures will promote the growth of the dengue virus and the spread of vector-borne diseases. Thus, we anticipate future dengue disease outbreaks based on the mentioned studies.

This study intends to examine the impact of dengue fever on tourist arrivals and Malaysia's economic growth. This study runs the Granger causality nexus between the selected indicators, i.e., foreign tourist arrivals, dengue disease cases, and economic growth.

LITERATURE REVIEW

Tourism-Led Economic Growth (TLEG)

From a long-run perspective, TLEG means a one-way causality between tourism growth and economic expansion. Empirical studies broadly support the view that tourism contributes to economic development, as evidenced in such countries as Barbados (Archer, 1984), Mauritius (Durbarry et al., 2002), Turkey (Gunduz and Hatemi-J, 2005), rural areas of Australia (Tovar et al., 2008), numerous other countries (Cárdenas-García, 2015; Castro-Nuño et al., 2013; Lee et al., 2008;) and in four islands (Narayan et al., 2010). Cardenaz-Garcia et al. (2013) found that the development of the tourism sector in 144 countries contributed to the rise in economic growth, verifying the tourism-led growth hypothesis. In 2016, the tourism industry contributed more than seven percent of the Malaysian economy and was the third major revenue after manufacturing and palm oil (Misachi, 2017). Foreign exchange earnings and tourism expenditure contributed to Malaysia's largest foreign exchange revenue. Malaysian tourism contributed RM182.4 billion, accounting for 14.8 percent of Malaysian revenue (Department of Statistics Malaysia, 2017). Foreign exchange earnings from the tourism sector also positively affected the economy, resulting in new investments and employment opportunities.

Some scholars support the perspective of the positive externalities of tourism development, indirectly impacting economic growth (Holzner, 2011; Tang & Jang, 2009), human capital growth, and infrastructure investment in Latin American countries (Fayissa et al., 2011). Archer et al. (1995) argue that tourism development brings about employment opportunities, higher total savings, and balance of payments improvement. Some scholars further argue that the economic development due to tourism will increase tourism revenue further in Fiji (Narayan, 2004), Korea

(Oh, 2005), and the United States (Tang and Jang, 2009) because of rapid economic growth, infrastructure upgrade, and education and safety improvement may attract foreign tourist arrivals.

Some studies support a bidirectional relationship between tourism and economic development in OECD and non-OECD countries (Lee et al., 2008), Korea (Chen et al., 2009), and Aruba (Ridderstaat et al., 2014). However, Katircioglu (2009) and Kasimati (2011) found a noncausal relationship where the tourism industry did not significantly impact economic development in Turkey and Greece.

This study links the tourism-led-growth hypothesis with dengue disease by suggesting that international tourist arrivals are negatively related to economic growth in a dengue disease condition.

Travel and Climate Change
Travel and global climate changes are primary problems affecting disease patterns (Hall, 2006). Because of cross-border phenomena, tourism can introduce new diseases to people worldwide. Hall (2006) and Richter (2003) mentioned that tourists travel to distant regions and may carry unaware pathogens back to their country. The United States Centre for Disease Control cautions that travellers who go to tropical and subtropical regions are at risk of getting dengue. The areas include parts of the Caribbean, Central and South America, Western Pacific Islands, Australia, Southeast Asia, and Africa.

People are moving around the world in greater numbers and at faster speeds than ever. The increased flows of foreign tourists mirror the fast movement and cluster of people, which may lead to increased danger of travel-related diseases, especially infectious diseases. Abdullah et al. (2000) found that deprived socioeconomic environments, poor hygiene, and social differences in tourists' origin countries and destinations are major factors in the increase of travel-related diseases. Thirty percent of tourists who visit tropical islands have to seek medical treatment for colds, stomach upsets, nausea, and diarrhea (Pearce, 1981). Wilks et al. (1995) discovered that 62 percent of tourists went to the nursing clinics on the tropical island because they contracted skin or eye infections and digestive, respiratory, and genitourinary disorders. For Australians travelling abroad, infectious diseases have been shown to cause 2.4 percent of deaths (Schmierer & Jackson, 2006).

Dengue fever is a common fever in returning tourists, contributing to 16 percent of all high fever diseases in returning travellers (Irani et al., 2013). Most cases of dengue infection among tourists were detected in tourists coming back from Asia, America, and Africa. The incidence of dengue in travellers returning from countries all over the world is even higher than that of malaria in a recent study on international tourism.

New epidemics are created from climate change (Hall, 2006). Richter (2003) found more than 36 new diseases are derived from tropical countries. Wilks et al. (1995) revealed that 62 percent of travellers who suffered from skin or eye, respiratory, and digestive problems went to nursing clinics in a tropical country. Pearce (1981) also reported that 30 percent of travellers to tropical islands had to find medical treatment for cold, nausea, and stomach upset.

Although tourists' unawareness and negligence are normally the reasons for the actual risk situations, the disease's perceived risk influences tourists' decision to choose a tourist destination. Potential travellers are sensitive to the existence of infectious diseases when they decide on a place to visit. Jaume Rosello et al. (2017) showed that infectious diseases determine tourist destination selections. The hazard of travel-related diseases is related to a 37 percent decrease in inbound tourism. They also found that dengue fever affects international tourism arrivals and national income.

HYPOTHESIS DEVELOPMENT

If there is a danger of infection when travelling to a specific destination, tourists are expected to choose an alternate country with no peril or low hazard. Therefore, an estimated coefficient for disease risk is expected to be negative. Dengue fever is a usual cause of fever in returning tourists (Irani et al., 2013). As potential tourists are less willing to travel during an epidemic or pandemic, communicable diseases negatively influence the tourism sector and its destinations. The disease issue has been rousing safe-haven tourists' anxiety. Travellers are hesitant to visit destinations suffering from various infectious diseases. Different local travel-related diseases (TRD) affect the destinations many tourists visit every year. Diseases are an important factor in determining tourist destination choices. Hence, the following hypothesis is formulated:

H1: Dengue disease risk leads to a decrease in international tourist arrivals.

Since the movement of people has been the cause for spreading infectious diseases in the past, it will remain to form the emergence, rate and dissemination of disease infections in various geographical areas. The increased volume of international tourist arrival mirrors the swift migration of big population clusters and the lack of hygiene and sanitation facilities, which may pose various risks to health and increase the risk of travel-related illnesses. Hall (2006) pointed out that tourism is the main factor affecting current and emerging disease patterns. Thus, the increase in international tourist arrivals may affect dengue fever cases. Hence, the following hypothesis is formulated:

H2: International tourist arrivals lead to an increase in dengue fever cases.

The foot-and-mouth disease impacts the pattern of British tourists (Blake et al., 2003). The risk of travel-related disease is linked to a decline of 37 percent in the tourist inflow, affecting the country's economic growth due to decreased tourist revenue and weakening foreign exchange, particularly in Malaysia, where tourism is the third biggest contributor to Malaysia's growth domestic productivity. Thus, infectious diseases such as dengue may reduce international tourists' willingness to visit Malaysia and lower tourist revenue, employment opportunities, and exchange rate earnings, impacting the country's economic growth. Thus, our hypothesis states that:

H3: Dengue disease risk moderates the link between international tourist arrivals and economic growth (GDP), such that the more (less) tourist arrivals cases lead to higher (lower) Malaysian economic growth under dengue disease risk.

Capital investment in tourism and tourist expenditures are substantial factors that influence a country's economic growth. Furthermore, the Economic Lead Tourism Growth (ELTG) theory suggests such rapid economic advancement will lead to a rise in tourism revenue, expansion of tourism infrastructure, education improvement and safety upgrades. This may then attract more international tourists to visit a region or nation. Thus, the fourth hypothesis tests the causality effect among the selected variables:

H4: A causality effect exists between dengue fever cases, international tourist arrivals, and economic growth.

DATA AND METHOD

Data

This study applies a simple regression analysis, moderation analysis, and Granger causality test for data analysis. A secondary data of 11 years of monthly data from January 2014 to December 2020 was collected. The period was chosen as dengue fever data was unavailable before 2014. The variables included in this study are international tourist arrivals as the dependent variable and dengue fever cases in Malaysia as the independent variable in the first hypothesis. However, in the second hypothesis, the dengue fever case is used as the dependent variable, while international tourist arrivals in Malaysia are treated as the independent variable. Lastly, for the third hypothesis, Malaysian gross domestic product (GDP) is analysed as the dependent variable, international

tourist arrivals are the independent variable, and dengue disease cases are treated as the moderating variable.

This study utilised dengue fever cases reported in Malaysia between 2014 and 2020. Secondary monthly dengue fever data was collected from the National Crisis Preparedness and Response Centre (CPRC)of the Ministry of Health Malaysia (MOH). The yearly Gross Domestic Product (GDP) data was converted into average monthly data and collected from the World Bank, whereas international tourist arrivals data was collected from the CEIC data and MY Tourism Data, Tourism Malaysia, with the cooperation of the Immigration Department.

The collected data were analysed using simple regression analysis, moderation analysis, and granger causality test. The statistical software employed in this study is E-view.

Method
Granger Causality Test
The short-term dynamic two-way panel causality between indicators is explored through cross-sections through models that support model heterogeneity. Dumitrescu et al. (2012) proposed a simple approach by testing the null hypothesis of homogeneous non-causality battle with the alternative hypothesis of heterogeneous non-causality. The data series employed in this test has to be stationary. The significance of this test is that it allows different logarithmic structures and unlimited coefficients of heterogeneity across the cross-section under the two hypotheses. Under the null hypothesis, no cross-sectional causality is tested against the alternative hypothesis of causality.

The estimated panel vector error correction model (VECM) can perform the Granger causality test (Pesaran et al., 1999). The team then used the two steps of Engle et al. (1987) to study the long-term and short-term dynamics. The first step is to estimate the long-term parameters in equation (1) and obtain the residual error corresponding to the balance deviation. The second step estimates the parameters related to short-term adjustments. The obtained equation is used in conjunction with the panel Granger causality test:

$$
\begin{pmatrix} \Delta C_t \\ \Delta V_t \\ \Delta V_t^2 \\ \Delta E_t \\ \Delta T_t \end{pmatrix} = \begin{pmatrix} \varnothing_1 \\ \varnothing_2 \\ \varnothing_3 \\ \varnothing_4 \\ \varnothing_5 \end{pmatrix} + \sum_{k=1}^{m} \begin{pmatrix} \vartheta_{1,1,k} & \vartheta_{1,2,k} & \vartheta_{1,3,k} & \vartheta_{1,4,k} & \vartheta_{1,5,k} \\ \vartheta_{2,1,k} & \vartheta_{2,2,k} & \vartheta_{2,3,k} & \vartheta_{2,4,k} & \vartheta_{2,5,k} \\ \vartheta_{3,1,k} & \vartheta_{3,2,k} & \vartheta_{3,3,k} & \vartheta_{3,4,k} & \vartheta_{3,5,k} \\ \vartheta_{4,1,k} & \vartheta_{4,2,k} & \vartheta_{4,3,k} & \vartheta_{4,4,k} & \vartheta_{4,5,k} \\ \vartheta_{5,1,k} & \vartheta_{5,2,k} & \vartheta_{5,3,k} & \vartheta_{5,4,k} & \vartheta_{5,5,k} \end{pmatrix}
$$

$$
\begin{pmatrix} \Delta C_{t-k} \\ \Delta V_{t-k} \\ \Delta V_{t-k}^2 \\ \Delta E_{t-k} \\ \Delta T_{t-k} \end{pmatrix} + \begin{pmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \\ \lambda_4 \\ \lambda_5 \end{pmatrix}.ECT_{t-1} + \begin{pmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \\ \mu_{4t} \\ \mu_{5t} \end{pmatrix} \tag{1}
$$

where ϕ_j (j = 1,2,3,4,5,6) represents the selected variable effect; k (k =1,…,m) is the optimal lag length determined by the Schwarz information Criterion (SC), $.ECT_{t-1}$ is the estimated lagged error correction term derived from the long-run relationship presented in Equation (1) and estimated via Equation (4), λ_j (j = 1,2,3,4,5,6) is the adjustment coefficient, and $\mu_{j,t}$ (j = 1,2,3,4,5,6) is the disturbance term assumed to be uncorrelated with zero means.

All error–correction vectors in Eq. (1) are estimated with the same lag structure ($p = q = r = s = w = m$) that is determined in unrestricted VAR framework.

In this study, we consider the following pair of regression to see the Granger causality test.

$$TA_t = C1 * GDP_{t-i} + C2 * TA_{t-j} + u1t$$
$$GDP_t = C3 * GDP_{t-i} + C4 * TA_{t-j} + u2t \tag{2}$$

$$TA_t = C1 * DF_{t-i} \; | \; C2 * TA_{t-j} \; | \; u1t$$
$$DF_t = C3 * DF_{t-i} + C4 * TA_{t-j} + u2t \tag{3}$$
$$DF_t = C1 * GDP_{t-i} + C2 * DF_{t-j} + u1l$$
$$GDP_t = C3 * GDP_{t-t} + C4 * DF_{t-j} + u2t \tag{4}$$

whereas,

TA is the total international tourist arrivals, *GDP* is the real gross domestic product growth of Malaysia, and *DF* is the total dengue fever cases in Malaysia.

Simple regression model

From the literature review and based on the proposed hypotheses, the models considered in this study can be defined as:

H1: Dengue disease risk leads to a decrease in international tourist arrivals.

$$LnTou_{i,t} = \beta_0 + \beta_1 LnDF + \varepsilon_{i,t} \tag{5}$$

Dengue fever (*DF*) cases are the independent variable, and international tourist arrivals (*Tou*) are the dependent variable.

H2: International tourist arrivals lead to an increase in dengue fever.

$$LnDF_{i,t} = \beta_0 + \beta_1 LnTou + \varepsilon_{i,t} \tag{6}$$

International tourist arrival (*Tou*) cases are the independent variable. Dengue fever (*DF*) is the dependent variable.

Moderation analysis

Moderation testing in behavioural science involves using linear multiple regression analysis or causal models. In order to quantify the influence of the moderating variables in the multiple regression analysis, the random variable Y is regressed to X, and an additional term is added to the model. The term is the interaction between X and the proposed moderating variable.

Thus, for a respond *Y*, variable x_1 and moderating variable x_2:

$$Y - b_0 + b_1 x_1 + b_2 x_2 + b_3 (x_1 \times x_2) + \varepsilon \tag{7}$$

In this study, x_2 plays a role as a moderate indicator and is accomplished by evaluating b_3, the parameter estimating on the interaction term.

H3: Dengue disease risk moderates the relationship between international tourist arrivals and economic growth

$$LnGDP_{i,t} - \beta_0 + \beta_1 Tou_{i,t} + \beta_2 DF_{i,t} + \beta_3 (Tou_{i,t} * DF_{i,t}) + \varepsilon_{i,t} \tag{8}$$

The dependent variable *GDP* is the real gross domestic product growth of Malaysia from January 2014 until December 2020. The explanatory indicators are illustrated as follows. *DF* as the dengue fever cases in Malaysia; *Tou* as the total figure of foreign tourists of destination region *i* during year *t*. In this study, *DF* appears as a moderate indicator and is accomplished by evaluating β_3, the parameter estimating the interaction term.

FINDINGS

In Table 1, the result in the first column reveals a significant positive relationship between travel-related diseases (TRD) risk and international tourist arrivals. The regression coefficient is 1.469, significant at a 1 percent level. However, the significant positive coefficient for tourist arrivals is not consistent with the expected sign. The increase in dengue fever cases leads to higher international tourist arrivals in Malaysia. It means that the dengue fever case is not the main issue in reducing tourists' desire to visit places in Malaysia due to the campaign in 1999 called "Malaysia Truly Asia". The initiative has successfully attracted over 7.9 million tourists to

Malaysia, generating around RM12.3 billion of revenue. Since then, the number of tourist arrivals has kept increasing every year.

Table 1
Effect of Dengue Fever on International Tourist Arrivals in Malaysia from 2014 until 2020

	International Tourist Arrivals (*Tou*)	Dengue Fever (*DF*)
LN(*DF*)	1.469 (0.005)***	-
LN(*TA*)	-	0.063 (0.005)***
R-squared	0.792	
F-statistic	8.358	
Observations	84	

Notes: ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$
DF is dengue fever cases. *TA* is international tourist arrivals.

Malaysia is one of the endemic countries due to higher weather conditions and vulnerable to flooding.. The result in the second column shows a significant positive relationship between the number of tourist arrivals and dengue fever cases. The regression coefficient is 0.063, significant at a 1 percent level. The result indicates that an increase in international tourist arrivals leads to higher dengue fever cases, consistent with the second hypothesis. The result is consistent with the study by Liebig et al. (2019), who showed that international travellers significantly contribute to dengue's rapid and large-scale spread by importing the disease from endemic to non-endemic countries. In non-endemic countries, local outbreaks are usually triggered by an imported case, where a person who acquired the disease overseas transmitted the virus to local mosquitoes (Chang et al., 2015).

The third hypothesis proposes that increasing dengue fever cases moderate with international tourist arrivals to higher Malaysian economic growth (GDP). The first column in Table 2 shows that from 2014 until 2020, the regression coefficient is 1.290 and is positively significant at 1 percent level. Between 2016 and 2020, the regression coefficients are positive at 0.324 and 0.902 and significant at 10 percent and 1 percent, respectively. In short, higher international tourist arrivals lead to higher economic growth even under dengue disease risks.

However, between 2017 and 2018, the result shows that an increase in international tourist arrivals leads to lower economic growth with dengue fever cases. The regression coefficients are -0.936 and -0.711, respectively, and both are significant at a 1 percent level. The result is not surprising since higher dengue disease cases lead to lower economic growth and is consistent with the proposed third hypothesis. This result is similar to the study by Jaume Rossello et al. (2017). They found that in the case of malaria, dengue, yellow fever, and Ebola, the eradication of these diseases in the affected countries (114 developed countries and 94 developing countries) would result in an increase in around 10 million tourists worldwide and a rise in tourism expenditure of 12 billion dollars.

Table 2
Effect of International Tourist Arrivals on Malaysian Economic Growth with Dengue Fever Risk

	2014-2020	2014	2015	2016	2017	2018	2019	2020
LN(*DF*TA*)	1.290	0.466	-0.115	0.324	-0.936	-0.711	0.122	0.902
	(0.000)***	(0.272)	(0.750)	(0.056)*	(0.008)***	(0.007)***	(0.454)	(0.008)***
R-squared	0.807	0.119	0.011	0.319	0.517	0.531	0.057	0.522
F-statistic	343.830	1.351	0.108	4.676	10.714	11.343	0.607	10.910
Observations	84	12	12	12	12	12	12	12

Notes: ***$p < 0.01$, **$p < 0.05$, *$p < 0.10$

DF is dengue fever cases. *TA* is international tourist arrivals

The fourth hypothesis proposes that Granger causality occurs between the selected variables: international tourist arrivals, dengue fever cases, and economic growth. Table 4 shows the results of the heterogeneous panel non-causality test obtained using the panel causality test of Dumitrescu et al. (2012). According to Schwarz Information Criteria (SIC), this study selects an appropriate lag length for empirical analysis, as shown in Table 3.

Table 3
Akaike Information Criterion to Detect the Maximum Lag Selection for Granger Causality F Test Statistics

	Lag=1	Lag=2	Lag=3	Lag=4	Lag=5
$Arrivals_t$ pair with GDP_t	27.675	27.552	27.528	27.564	27.677
$Arrivals_t$ pair with DF_t	45.563	45.439	45.272	45.271	45.289
DF_t pair with GDP_t	18.223	18.047	17.831	17.754	17.716
Observations	84	84	84	84	84

Overall, our causality test results show a significant causal nexus between international tourist arrivals, economic growth, and dengue fever from lag 1 until lag 5, at 1 percent and 5 percent significant levels. These findings, therefore, suggest that tourist arrivals, dengue fever cases ,and economic growth drive each other in the short run.

Table 4
Granger Causality Test between Tourist Arrival, Economic Growth and Dengue Fever

Null Hypothesis	Lag = 1	Lag = 2	Lag = 3	Lag = 4	Lag = 5
	Granger causality F test statistics				
$Arrivals_t$ does not cause Y_t	7.066***	5.194***	5.115***	3.545***	2.660**
Y_t does not cause $Arrivals_t$	0.003	3.341**	3.026**	3.582***	2.527**
$Arrivals_t$ does not cause DF_t	1.182	1.034	3.229**	2.740**	1.704
DF_t does not cause $Arrivals_t$	4.768**	7.811**	5.807***	4.736***	3.342***
DF_t does not cause Y_t	21.356***	13.292***	8.035***	11.95***	7.599***
Y_t does not cause DF_t	1.906	2.239*	2.654**	6.294***	6.892***
Observations	84	84	84	84	84

Asterisks indicate significance levels at **0.05 and ***0.01.
$Arrivals_t$ is international tourist arrivals, Y_t is real gross domestic productivity, and *DF* is dengue fever cases.

DISCUSSION AND CONCLUSION

Past studies reveal that health and macroeconomics are strongly correlated. A nation's good health determines one country's economic growth since a higher level of labour productivity, investment, and education accelerates economic well-being. In a nutshell, dengue infection by international tourists arises regularly and may lead to extensive illnesses. This paper is the first to contribute to an investigation of international tourist arrivals' impact on economic growth under dengue disease risks in Malaysia. The result reveals that, between 2014 and 2020, there was a significant and positive relationship between dengue fever cases and international tourist arrivals. Higher tourist arrivals led to increased economic growth even when there were dengue disease risks, except in 2017 and 2018 when higher international tourist arrivals led to decreased economic growth under dengue fever conditions. The R-square in the findings was small due to the small sample size. The data for dengue fever cases before 2014 was unavailable. Extensive data on dengue fever cases

should be explored in future research. The empirical findings also demonstrate the causality between international tourist arrivals, economic growth, and dengue fever cases.

This research is the first to contribute to an analysis of the impact of dengue disease on international tourist arrivals and economic growth. All instruments used in this research have been designed, measured, and validated within the context of Malaysian dengue fever risks, the tourism industry, and the economy. This research supplements the literature on tourism development and economic risks sunder the dengue fever issue.

This study has prompted government surveillance on dengue disease risk, which is contagious and likely to transmit to more people. The prevention and recovery policies may then be decided upon based on the number of dengue cases and the degree of economic burden inflicted by a dengue outbreak. Government and policymakers may introduce new strategies to integrate and enhance vector control, whereby all existing control methods should be merged in the most practical, cost-effective and secure aspect to sustain acceptable vector population levels. The number of dengue cases and the extent of economic strain caused by a dengue endemic may then urge the government and private companies to suggest prevention and recovery plans and policies. Nevertheless, the tourism sector should continue to plan many promotional campaigns, special events and products that introduce Malaysian uniqueness to attract more tourists to the country despite the potential risk of dengue infections.

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