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Vulnerability and Readiness of Malaysian Economy in the Context of Environment Degradation

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Abstract. The threat of climate change and environment degradation has influenced tourist activities. The purpose of this study is to quantify the effects of climate change on tourism and economy in Malaysia. The vulnerability and readiness to climate change that impact tourism and economy are examined. The empirical results reveal the effect of vulnerability is greater than the readiness components in both tourism and overall economy in Malaysia. Health factors on vulnerability to climate change are significantly jeopardizing both tourism and overall economy in Malaysia. Besides that, greenhouse gas emissions and SARS epidemic disease also contributes to the losses of tourism industry in Malaysia.

1. Introduction

Climate change has been the main focus of international agenda in forming the future with energy, food security, biodiversity, health, and population growth. It will change the way we live and govern a more interdependent world. The climate change literature has largely concentrated on mitigation actions by global warming and contributors to greenhouse gas emissions from developed and industrialized countries such as China, India and Brazil. Small and less industrialized countries which are not large contributors to the problem of climate change are the most impacted by the climate change and environment degradation. These countries are highly dependent on tourism industry and thus are vulnerable to the effects of the climate change. The environmental and climatic conditions of a destination are key resources that shape and drive the success of tourism sector [1]. The trend of tourist flows alters due to climate change [2]. Tourists' decisions of where to go are dependent on environmental quality, security and health factors.

Malaysia is a popular tourism destination in the world and it was ranked top 10 tourist destinations in the world and the world's fifth best shopping places by Expedia UK 2016. According to the data by Social Statistics Bulletin, Malaysia [3], Malaysia has attracted 25,721,251 in 2015 and this figure has increased to 26,757,392 tourists in 2016, an increase of 4.0 per cent. In 2016, the highest percentage of tourists was from Singapore (13,272,961 visitors). This was followed by tourists from Indonesia (3,049,964 visitors) and China (2,142,942 visitors). Tourism sector has been the second largest foreign exchange earner for Malaysia since 2000. Therefore, Malaysia could constitute an important case study.

Malaysia has encountered numerous environmental issues including pollution and therefore initiated green practices in 1997. Green practices were included in the Eighth and Ninth Malaysia Plan and reinforced in the National Green Technology Policy 2009. Consequently, hotels and tourism industry in Malaysia incorporated practices but the acceptance is still quite slow.



Tourism studies such as Habibi et al. [4] as well as Hanafiah and Harun [5] investigate the inflow of tourism demand in Malaysia. However, none of them have considered the vulnerability and readiness of climate change on Malaysian tourism industry. Malaysian tourism industry needs to be capable and ready in handling the effect of climate change to grab the world competitive advantage. Inefficiency in dealing with the climate change issue could result in failing to secure future investment in tourism sector. Therefore, conducting empirical studies to tourism due to climate change is crucial as it may provide a reference for policy makers to plan for crisis management contingencies in order to avoid losses.

This study pays attention to vulnerability and readiness evaluations of the tourism sector in Malaysia. These two approaches are crucial in promoting the success of mitigation strategies in the tourism industry. Vulnerability and readiness framework explains the at-risk and strength of a country in tackling the effect of climate change [6] [7]. A vulnerability and readiness framework incorporates climatic, crises, economic, social and governance factors and thus quantifies its effects of climate change [8].

Hence, in this study, we will build a vulnerability and readiness to climate change framework and also investigate the impact of vulnerability and readiness on tourism sector and overall economy in Malaysia.

2. Literature review

A number of researchers such as Gössling et al. [9] and Ruddy et al. [10] have shown that climate change negatively affects the tourism sector. Massida and Etzo [11] emphasized that quality of environment is a main criteria in selecting a tourism destination. Fluctuating and extreme weather such as strong wind, severe thunderstorm, flood and haze would influence tourists' mood and health safety. Shahbaz et al. [12] reported that emission of CO₂ in Malaysia has increased tremendously from 121,132 kilo-tonnes in 1995 to 242,821 kilo-tonnes in 2014. Thus it has polluted the air and degraded the environment in Malaysia. Solarin [13] also documented that tourism in Malaysia is affected by the air quality using Granger causality results.

Nevertheless, depending on changes in climatic variables alone are insufficient in predicting tourism demand and patterns [14]. It fails to involve changes in economic, political and social factors in assessing climate change impacts [15].

Tourism crises such as natural disasters, epidemic disease outbreak and terrorism affect tourism industry in Malaysia [4] [5]. Tourism crises endanger the safety of tourists. SARS epidemic outbreak in 2003 has significantly affected Malaysian tourism sector. Data shows that tourist arrivals to Malaysia have decreased from 13.2 million in 2002 to 10.5 million in the following year. The loss of 17.44 per cent of total receipt in 2003 was recorded. Hotel occupancy rates in Malaysia are only 30 percent in April 2003. The number of air flight reservations has fallen by 40 per cent [16]. They also found that tourism crises have eventually suppressed the development of Malaysian tourism.

A vulnerability and readiness evaluation is a full process that incorporates predicted modification in climatic variables and life aspects indicators such as access to health service, urbanization level as well as resources to react to climate change such as economy, social and political level. Dogru et al. [8] built a conceptual link between climate change and tourism demand. They have analyzed the impact of vulnerability and resilience on tourism industry in the Mediterranean Countries. This paper develops on the framework suggested by Dogru et al., but has added SARS epidemic outbreak into the framework.

3. Research hypotheses

Vulnerability evaluation of the tourism sector to climate change involves exposure evaluation of other basic, life aspects components. These components are health, infrastructure, greenhouse gas emission, and SARS epidemic disease. Impoverished health status and lack of health specialists as well as quality of infrastructure make a country more vulnerable to climate change. Greenhouse gas emission and SARS epidemic disease are also included to evaluate a country's susceptibility to climate change.

Based on the vulnerability theory, we suggest that higher vulnerabilities of health, greenhouse gas emission, infrastructure and SARS epidemic disease are positively related to vulnerability to climate change and therefore both tourism sector and economy are projected to be negatively affected (as shown in Figure 1).

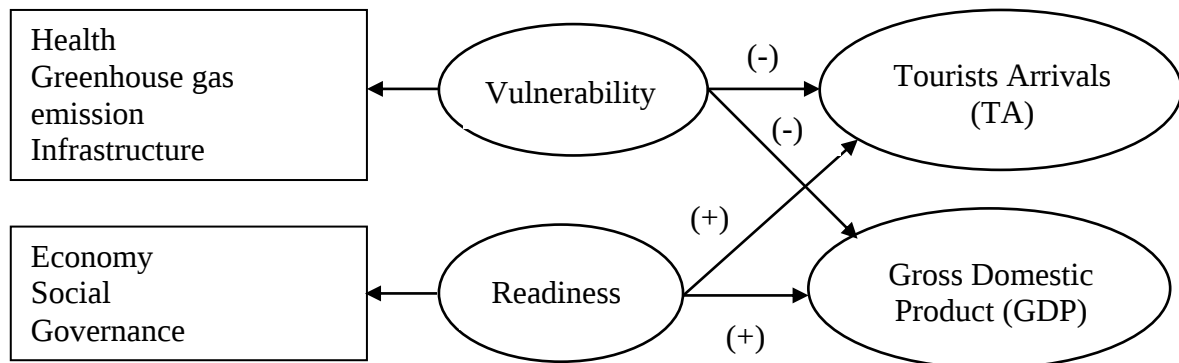


Figure 1. A framework of vulnerability and readiness to climate change.

Hence, the proposed hypotheses are as follow:

H1: The higher the vulnerability to climate change, the lower the number of tourist arrivals in Malaysia.

H2: The higher the vulnerability to climate change, the lower Malaysian gross domestic product.

A country's economic environment, social conditions and political stability determine its readiness to climate change. Such components influence the ability to implement adaptation and mitigation strategies for climate change. Government spending, trade freedom, ease of doing business, education level, violence and rule of law are quantifiable elements for economic, social and political readiness. Economic freedom boosts local and foreign investment to carry out adaptation and mitigation strategies. The level of inequality, education status and technology tell a country's social readiness. A good governance and stable political environment would encourage domestic and foreign company investments. In order to cope with the impacts of climate change, all economic, social and political readiness play salient parts in implementing mitigation and adaptation strategies.

Therefore, we postulate the higher the economic, social and political readiness suggest higher readiness to climate change and therefore both tourism sector and economy are projected to be positively influenced (Figure 1). The proposed hypotheses are as follow:

H3: The higher the readiness to climate change, the higher the number of tourist arrivals in Malaysia.

H4: The higher the readiness to climate change, the higher Malaysian gross domestic product.

4. Methodology and Data

In this study, the dependent variables are number of tourist arrivals in Malaysia (*TA*) and Malaysia gross domestic product (*GDP*). Number of tourist arrivals in Malaysia (*TA*) and Malaysia gross domestic product (*GDP*) were retrieved from the online database from World Bank (The World bank, 2019). The independent variables are vulnerability (*VUL*) and readiness to climate change (*RED*). Variables on vulnerability and readiness components were retrieved from Notre Dame Global Adaptation Institute [17]. The time frame for the annual data is a period of 1995-2017.

Initially, degree of vulnerability and readiness to climate change affect Malaysian tourism demand and Malaysian income are analyzed. The empirical models are shown in the following:

$$\ln TA_t = \alpha_0 + \alpha_1 VUL_t + \alpha_2 RED_t + \varepsilon_t \quad [1]$$

$$\ln GDP_t = \mu_0 + \mu_1 VUL_t + \mu_2 RED_t + \varepsilon_t \quad [2]$$

where α_0 and μ_0 are constants; $\ln TA_t$ is natural logarithmic of number of tourist arrivals in Malaysia during the year t ; $\ln GDP_t$ is natural logarithmic of Malaysia gross domestic product (US\$) during the year t ; VUL_t is vulnerability to climate change during the year t ; RED_t is readiness to climate change during the year t and ε_t is the random error term.

The degree to which the vulnerability and readiness components influence tourism sector and economy is further explored to understand the distinctive effects. Number of tourist arrivals in Malaysia (TA) and Malaysia gross domestic product (GDP) are modeled as functions of health ($HEALTH$), greenhouse gas emission (GHG), infrastructure ($INFRA$), SARS epidemic disease ($SARS$), economy ($ECON$), social (SOC) and governance (GOV). $SARS$ variable is represented by a dummy variable. The empirical models are expressed as shown in the following:

$$\ln TA_t = \beta_0 + \beta_1 HEALTH_t + \beta_2 GHG_t + \beta_3 INFRA_t + \beta_4 SARS_t + \beta_5 ECON_t + \beta_6 SOC_t + \beta_7 GOV_t + \varepsilon_t \quad [3]$$

$$\ln GDP_t = \lambda_0 + \lambda_1 HEALTH_t + \lambda_2 GHG_t + \lambda_3 INFRA_t + \lambda_4 SARS_t + \lambda_5 ECON_t + \lambda_6 SOC_t + \lambda_7 GOV_t + \varepsilon_t \quad [4]$$

where β_0 and λ_0 are constants; $HEALTH_t$, GHG_t , $INFRA_t$, $ECON_t$, SOC_t , GOV_t are vulnerabilities of health, greenhouse gas emission, infrastructure, economy, social and governance during the year t ; dummy variable $SARS$ is the dummy variable for SARS epidemic disease with a value of 1 during the year of crisis and is 0 otherwise and ε_t is the random error term. Epidemic disease occurs within a specific period in an identifiable time and space [18]. Since time series information embedded in the data is essential to reflect the behavior of tourist arrivals in Malaysia and Malaysian income, we will use panel data regression to study the dynamics of changes on tourist arrivals in Malaysia and Malaysian income within a specific time of duration.

5. Results

Table 1 presents the impact of vulnerability and readiness to climate change on number of tourist arrivals in Malaysia and Malaysian income. The results show that the coefficient of vulnerability to climate change is statistically significant and has an impact on both number of tourist arrivals in Malaysia and Malaysian income.

Table 1. The impacts of vulnerability and readiness on number of tourist arrivals in Malaysia (TA) and Malaysia gross domestic product (GDP).

Variable	Dependent variable: $\ln TA$		Dependent variable: $\ln GDP$	
	Coefficient	Probability value	Coefficient	Probability value
Constant	39.941	0.000***	46.710	0.000***
Vulnerability	-60.284	0.000***	-56.390	0.000***
Readiness	-0.4280	0.892	1.582	0.576

*** denotes the level of significance at 1%

The results also report that vulnerability to climate change has a negative impact on both on number of tourist arrivals in Malaysia and Malaysian income. This result support the hypotheses $H1$ and $H2$, which we propose the higher the vulnerability to climate change, the lower the number of tourist arrivals in Malaysia and Malaysia gross domestic product. Nevertheless, the degree of vulnerability to climate change in number of tourist arrivals in Malaysia is more than its impact to Malaysia gross domestic product (TA : -60.284 vs. GDP : -56.390). Although tourism encounters adverse effects from climate change, it is the most vulnerable sector due to its singular reliance on climate resources.

The effects of readiness on number of tourist arrivals in Malaysia fail to corroborate hypothesis $H3$, 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 2 presents the effects of vulnerability components such as health, greenhouse gas emission, infrastructure, SARS epidemic disease and readiness components such as economy, social and governance on number of tourist arrivals in Malaysia and Malaysia gross domestic product. The results in column 1 show that coefficients of health, greenhouse gas emission and SARS epidemic disease are statistically significant. These findings supported our postulations with the exception of vulnerability of infrastructure, though it is not significant. The coefficients of health, greenhouse gas emission and SARS epidemic disease suggest that the higher the vulnerability of these indicators, the number of tourist arrivals in Malaysia is adversely affected. The coefficient of health indicates that a 1 per cent increase in vulnerability of health sector to climate change would cause 34.42 per cent decrease in the number of tourist arrivals in Malaysia. The impact of this health sector vulnerability on number of tourist arrivals in Malaysia is much greater than greenhouse gas emission and SARS epidemic disease vulnerabilities. A 1 per cent increase in the vulnerability of greenhouse gas emission effect to climate change would only decrease 2.39×10^{-6} per cent in the number of tourist arrivals in Malaysia while a 1 per cent increase in the vulnerability of SARS epidemic disease to climate change would decrease 0.426 per cent in the number of tourist arrivals in Malaysia.

In column 1 of Table 2, the coefficient readiness of economy to climate change reports a significantly negative effect on number of tourist arrivals in Malaysia. This does not align to our prediction that readiness of economy will have a positive impact on number of tourist arrivals in Malaysia. Nevertheless, readiness of governance to climate change shows a significant positive effect on number of tourist arrivals in Malaysia. This finding is in line with our prediction that the increased readiness on political stability and rule of law, the tourism industry becomes more ready to counter climate change impacts. A 1 per cent in the readiness of governance to climate change would cause 2.6 per cent increase in number of tourist arrivals in Malaysia.

Table 2. The impact of vulnerability and readiness components on *TA* and *GDP*.

Variable	Dependent variable: $\ln TA$		Dependent variable: $\ln GDP$	
	Coefficient	Probability value	Coefficient	Probability value
Constant	25.612	0.0007***	39.838	0.0000***
HEALTH	-34.419	0.0091***	-50.217	0.0000***
GHG	-2.39×10^{-6}	0.0236**	1.61×10^{-7}	0.7835
INFRA	11.806	0.2224	14.827	0.0184**
SARS	-0.426	0.0032***	-0.115	0.1410
ECON	-2.611	0.0422**	-0.670	0.3611
SOC	1.795	0.3063	4.955	0.0002***
GOV	2.604	0.0969*	2.016	0.0386**

*** denotes significance level at 1%; ** denotes significance at 5%; * denotes significance at 10%

In column 2 of Table 2, the effects of health and infrastructure are statistically significant. The coefficient health indicates 1 per cent increase in the vulnerability of health sector to climate change would cause 50.22% decrease in Malaysian economy. On the other hand, a 1 per cent increase in the vulnerability of infrastructure sector to climate change would increase Malaysian economy by 14.83%. This is contrary to our conjecture that an increase in infrastructure sector's vulnerability has a negative impact on Malaysian economy.

The results in column 2 of Table 2 also show that readiness of social and governance report a significant positive effect on Malaysia gross domestic product. A 1 per cent increase in the readiness on social factors to climate change would increase 4.95 per cent in Malaysia gross domestic product while a 1 per cent increase in the readiness on governance factors to climate change would increase 2.02 per cent in Malaysia gross domestic product. Political stability, rule of law, technology and social

facility as well as education level positively impact Malaysian overall economy with increased readiness in social and political factors in facing climate change.

6. Conclusion and Implications

The tourism sector in Malaysia is a prime contributor to the economy. The government is pushing the tourism sector to greater heights in line with the Malaysia Tourism Transformation Plan. According to Malaysian Investment Development Authority (MIDA), Malaysia has to attract 36 million tourists and generate RM168 billion in revenue from the tourism industry by year 2020. However, the plan cannot be realized without natural resources which would be affected by climate change and environment degradation. Thus, investigating adverse impacts of climate change, especially health sectors, is crucial in mitigating vulnerability effects.

The results in the empirical study reveal that tourism sector is extremely susceptible to climate change. The impact of vulnerability to climate change is more than those of readiness to climate change. Thus, mitigation policies to decrease climate change negative factors such as greenhouse gas emission requires immediate attention. Policy makers could enforce a carbon tax on polluters, provide tax incentives to firms that consume less fossil fuel and hence encourage companies to invest in energy-saving technologies. The government could also initiate an emission trading programme and impose strict environmental regulations.

The exposure of SARS epidemic disease to the environment in the tourist destination influences the tourists' decision to travel as they are very sensitive towards their personal health safety. Thus, policy makers must not neglect the incident occurring in the surrounding environment of Malaysia as it may indirectly impact tourism industry. Ecotourism, food and medical tourism can be expanded and improved to attract more tourists to Malaysia as this type of tourism boost the environmental awareness and commitment in the country.

The results also reveal that overall economy is as vulnerable to climate change as the tourism industry and it displays adequate readiness to tackle with the environment. As Malaysian economy is greatly depending on natural and climatic resources, the readiness in social and political infrastructures must be better developed and enhanced. The government, particularly the Royal Malaysian Police and the Ministry of Health should formulate strategies to ensure the country is peaceful and free from infectious disease to deal with climate change.

Despite its significant contributions to the tourism literature, especially Malaysia tourism sector, this study can be further examined and compared to other sectors of the economy such as agriculture and energy. Tourism is not the only industry that is vulnerable to climate change, other specific sectors might be even more vulnerable.

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