

Assessing the Impacts of Tourism Climate Index and Holiday Climate Index on Tourism Demand in Malaysia

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Abstract

This study aims to investigate the impacts of climate change on tourism demand in Malaysia. To date, this is the first study to employ the tourism climate index (TCI) and the holiday climate index (HCI) to examine the linkage between climate variables and tourism demand in Malaysia. Both the TCI and the HCI were constructed by integrating several climatic variables – temperature, humidity, precipitation, cloud cover, duration of sunshine, and wind speed into a single numerical index. The climate indexes were theoretically based on the biometeorological literature to reflect human thermal comfort. This paper utilized the effective temperature to measure human thermal comfort based on the ASHRAE-55 standard and employed monthly data from 2010 through 2020. The weather data were gathered from The Weather Online. Meanwhile, the number of international tourist arrivals to Malaysia was collected from the Ministry of Tourism Malaysia. The empirical outcomes of this study show that both the TCI and the HCI illustrated similar trends with the tourist visitation pattern in Malaysia. These results indicate that the climatic conditions potentially affect demand in Malaysia's tourism industry. Therefore, both the TCI and HCI provide valuable insights to the Malaysian government and key industry players to design tourism policies and products. Lastly, this study also contributes to the literature related to tourism studies.

Keywords: Tourism climate index (TCI), Holiday climate index (HCI), Tourism demand, ASHRAE-55, Thermal comfort, Sustainable growth.

Introduction

The tourism industry is one of the largest and fastest-growing industries around the globe. It plays a crucial role in driving economic development, creating job opportunities, driving prosperity, and empowering various people across the full spectrum of society. The world tourism industry accounted for 10.3% (USD8.9 trillion) of global GDP in 2019 (WTTC, 2020). In 2019, the world tourism industry grew 3.5% globally, as compared to the preceding year. This growth was also higher than the overall GDP growth of 2.5% around the globe, indicating that the tourism industry was performing at a promising rate. Besides that, the world tourism industry has created 330 million job opportunities, which is one in ten jobs around the world (WTTC, 2020). The Asia Pacific region was the fastest-growing region with 5.5% growth, and it contributed USD3.0 trillion of global GDP in 2019. In that year, 360.7 million international tourists visited the Asia Pacific region, which is a 3.5% increase over 2018 (UNWTO, 2020). In addition, the Asia Pacific region was the leader in job creation over the past five years, and it has created 21.5 million new jobs or equivalent to 56% of all new jobs worldwide. The total tourism employment in the region represented 55% (182 million jobs) of all sectors' jobs globally in 2019 (WTTC, 2020). Specifically, Southeast Asia region played a crucial role in the tourism market by accounting for 38.1% (137.4 million tourists) of total international tourist arrivals and 33.3% (USD147.6 trillion) of total international tourism receipts in the Asia Pacific region.

Due to the outbreak of the COVID-19 pandemic, the world tourism industry has been tremendously impacted by ongoing travel restrictions around the globe. In 2020, the world tourism industry suffered a total loss of USD4.5 trillion, and the tourism contribution declined a staggering 49.1% as compared to 2019 (WTTC, 2021). Furthermore, domestic visitor expenditure declined by 45.0% while international visitor spending decreased an unprecedented 69.4% due to restrictions on travel movement. The outbreak of COVID-19 pandemic also caused 62 million or 18.5% of tourism jobs lost globally in 2020. According to UNWTO (2022a), the world tourism industry showed signs of recovery in 2021, with a 4.0% growth of international tourist arrivals around the globe. Although the world tourism industry received 400 million tourist arrivals in 2021, this figure was still 72.0% below the pre-pandemic year of 2019. In January 2022, global tourism enjoyed a significant rebound of 130% more international tourist arrivals as compared to 2021 (UNWTO, 2022b). Thus, the world tourism industry is showing strong momentum of recovery in 2022, thanks to vaccination programs and the easing of travel restrictions around the globe.

Indeed, Malaysia has been ranked as one of the most popular tourism destinations in the Southeast Asia sub-region. In 2019, the Malaysian tourism industry had received 26.1 million international tourist arrivals and generated USD19.8 billion of international tourism receipts in 2019 (WTTC, 2021). According to the Department of Statistics Malaysia (2020), the tourism industry continues to perform with good momentum, and its significant growth has contributed 15.9% of Malaysian's GDP in 2019. In addition, the Malaysian tourism industry has created 3.6 million job opportunities which is equivalent to 23.6% of total job employment in Malaysia. However, the COVID-19 pandemic had a huge impact on Malaysian tourism industry in 2020 and 2021. According to Tourism Malaysia (2022), the number of international tourist arrivals in Malaysia plunged by 83.4% in 2020 and it furthered to 97.0% in 2021. Meanwhile, the Malaysian international tourism receipts declined to USD3.0 billion (-

84.7%) in 2020 and then to USD0.06 billion (-98.1%) in 2021 due to movement restrictions around the globe.

Table 1: Total International Tourist Arrivals in Malaysia, 2010-2021

Year	Million Person	Growth
2010	24.6	3.9%
2011	24.7	0.5%
2012	25.0	1.3%
2013	25.7	2.8%
2014	27.4	6.7%
2015	25.7	-6.3%
2016	26.8	4.0%
2017	26.0	-3.0%
2018	25.8	-0.5%
2019	26.1	1.1%
2020	4.3	-83.4%
2021	0.1	-97.0%

Source: Tourism Malaysia (2022).

During the pre-pandemic era, Malaysian tourism played a dominant role in contributing to the prosperity of the population and economic development; however, it still poses a great challenge to sustain its growth in the Southeast Asia region. In 2010, Malaysian tourism shared a quarter (26.4%) of international tourism receipts in the Southeast Asia market; nevertheless, its share dropped dramatically to 13.4% in 2019. In addition, the number of total international tourist arrivals in Malaysia fluctuated in between 2010 and 2019. Since 2010, the number of tourist arrivals in Malaysian showed a good momentum, and the growth of tourist arrivals peak at 6.7% in 2014. However, the number of tourist arrivals declined by 6.3% as compared to the preceding year due to lower financial allocation for various publicity and promotional activities. Additionally, the number of tourist arrivals visiting Malaysia for tourism purpose saw a slower pace in the following years, and here is where extra attention is needed. As a result of these critical drops, it is crucial to investigate the determinants affecting tourism demand in Malaysia in order to promote its sustainable growth in the long term.

Given the predominant role of the tourism industry in the global economy, UNWTO advocates the industry's sustainable growth to achieve the universal 2030 Agenda for Sustainable Development Goals (SDGs). Under SDGs, climate change is a key component that requires urgent action to be taken by the countries. The tourism industry is highly vulnerable to climate change, and this vulnerability, which can negatively impact the attractiveness of tourism destinations has long been debated by numerous researchers (Matthews et al., 2019; Jeuring, 2017; Maddison, 2001; Lohmann & Kaim, 1999; Wall & Badke, 1994). Furthermore, Hindley and Font (2018), Ruttty and Scott (2015), and Maddison (2001) studied the relationship between the climate condition, destination choices and the motivation of tourists. Meanwhile, Arabadzhyan et al. (2021) and Boivin and Tanguay (2019) examined the influence of the climate condition on the attractiveness of the tourism destinations. They stated that the attractiveness of the destinations will affect the tourists' preferences regarding the selection of their travel destinations, the timing of travel, and the enjoyment of their overall trip.

Therefore, the climatic resources are significantly affecting the tourists' travel decision and it will affect the tourism expenditure in the particular tourism destination. Thus, the close link between the tourism industry and climate makes the industry vulnerable to global climate change. In addition, in order to enhance the tourism competitiveness, the government needs to take into account both macroeconomic and non-macroeconomic variables, thus it is crucial to include the climatic variables which are tourism climate index (TCI) and holiday climate index (HCI) into our empirical models. Since the tourism industry plays a vital role in Malaysia, it is crucial to investigate the impact of climate on Malaysian tourism. To date, several climatic studies have been conducted to examine the impacts of climate change on the agricultural sector (Alam et al., 2012; Siwar et al., 2009), the fisheries industry (Shaffril et al., 2017), and food security (Vaghefi et al., 2016) in Malaysia. However, very few studies employ the tourism climate index (TCI) and the holiday climate index (HCI) to examine the impact of climate change on the tourism industry in Malaysia. Therefore, this research gap has further motivated us to conduct this study to gather more comprehensive tourism information in Malaysia. This study will contribute to the existing literature by investigating impacts of climate on the Malaysian tourism industry. Precious knowledge about the impact of climate change on Malaysian tourism industry can minimize its adverse impacts to the overall industry.

Literature Review

In the existing studies, an extensive number of published studies examined the factors affecting tourism demand. The tourism demand is generally proxied by tourist arrivals (Puah et al., 2022; Soh et al., 2022; Jong et al., 2020). Meanwhile, the factors impacting tourism include tourists' income (Ulucak et al., 2020; Habibi, 2017; Tanjung et al., 2017; Thien et al., 2015), tourism price (Tang & Tan, 2016; Puah et al., 2014), exchange rate (Jong et al., 2022; Ulucak et al., 2020; Meo et al., 2018; Thien et al., 2015; Puah et al., 2014), transportation cost (Jong et al., 2020; Soh et al., 2020; Shafiullah et al., 2019; Soh et al., 2019), and word of mouth (Preko et al., 2020; Habibi, 2017; Habibi & Abbasianejad, 2011). Researchers have consistently pointed out that tourists' income is positively associated with tourism demand in Malaysia. Their findings indicated that tourists tend to travel abroad when their income level is higher, and thus they have higher purchasing power to travel abroad for leisure purposes. Besides that, Jong et al. (2020) showed that tourism price adversely impacts tourism demand, which is in line with the findings of Tang and Tan (2016) and Habibi and Abbasianejad (2011). As expected, Jong et al. (2020) and Habibi (2016) have proven that transportation cost negatively affects tourism demand in Malaysia. In contrast, Tanjung et al. (2017) figured out that transportation cost is positively associated with demand from Indonesian tourists in Malaysia. This is because Indonesia is a neighboring country of Malaysia, and thus the geographical distance is relatively shorter than other countries. For example, when the oil price increases, then airfares for Thai and Indonesian tourists traveling to Malaysia is relatively cheaper than travelling to other long-haul countries. Furthermore, Habibi (2017), and Habibi and Abbasianejad (2011) found that habit persistence (word of mouth) positively influences the demand for Malaysian tourism. Hence, industry players must improve the quality of their services and their brand image. While many studies have been devoted to assessing the macroeconomic determinants affecting tourism demand, limited attention has been given to the climatic impacts on Malaysian tourism. Therefore, the climatic variables which are TCI and HCI

will be included in our empirical models to investigate their impacts on tourism demand in Malaysia.

Nevertheless, in the recent decades, some researchers have shown increasing interest in the effect of climate on tourism demand. Although climate is among the factors influencing tourists' decision to travel, some tourists' decision to visit a destination is governed entirely by the state of the climate (Mieczkowski, 1985). While non-climatic factors influence some tourists to travel, they still tend to select a certain period when the climate is at its best. Accordingly, numerous researchers have studied the impact of climate on tourism industry. In 1985, Mieczkowski constructed the tourism climate index (TCI) based on biometeorological literature to assess the suitability of climate for the tourism industry. This index was designed by integrating several climatic variables into five sub-indexes to reflect climatic conditions. Each sub-index has its own weightage to reflect its level of importance relative to other climatic variables. Since the development of the TCI, it has been widely employed in many countries and regions, including Europe (Scott et al., 2016; Perch-Nielsen et al., 2010; Nicholls & Amelung, 2008), the Caribbean (Rutty et al., 2020; Moore, 2010), Egypt (Mahmoud et al., 2019), Iran (Hejazizadeh et al., 2019; Roshan et al., 2009), and China (Zhong et al., 2019; Fang & Yin, 2015).

Although many existing studies have employed the TCI, numerous researchers, including Rutty et al. (2020) and Scott et al. (2016), Amelung et al. (2007), and de Freitas (2003) have pointed out some of its shortcomings. The main criticism is the TCI's weighting system for the climatic variables that is based on Mieczkowski's own judgment rather than being scientifically validated against visitor preferences or other tourism performance metrics. Another drawback is the excessive emphasis on the thermal comfort in constructing the TCI. The thermal comfort component accounts for half of the total weightage in the TCI. Moreover, the neglect of the possibility of the overriding effect of physical climatic parameters such as rain and wind are another major deficiency identified in the construction of the TCI. Furthermore, the low temporality of climate data (monthly data) has been criticized, as tourists tend to reflect on daily climatic conditions.

Of particular concern on the limitations of the TCI, Morgan et al. (2000) designed the Beach Climate Index (BCI) to overcome the issues arising in TCI. The BCI was designed to better understand the beach users' preferences on the climate. They conducted questionnaire surveys to figure out the beach users' preferences on thermal sensation and bathing temperature, and also the level of importance of other climatic attributes in the North European. They figured out that July and August were the unpleasant months as these months were the peak of the summer season. The tourists were diverting to spring and autumn seasons which were deemed as more pleasant periods with more comfortable climatic conditions. Furthermore, Freitas et al. (2008) introduced the Climate Index for Tourism (CIT) to overcome the limitations argued in the TCI. They integrated a few climatic facets which were thermal, aesthetic, and physical facets into a weather typology matrix to reflect the satisfaction level of the climatic condition, ranging from 1 (very poor/unacceptable) to 7 (very good/optimal). They concluded that this index is reliable for beach-based tourism and recreation activities as it includes the thermal, aesthetic and physical weather facets in CIT.

However, Scott et al. (2016) argued that both the BCI and CIT were constructed for sun, sea, and sand (3S) activities and not for general tourism segments. Therefore, Scott et al. (2016) constructed the Holiday Climate Index (HCI) for major tourism segments to overcome all these limitations. One of the major advancements for the HCI is the scale ratings of the variables and the weighting scheme were developed using existing literature on visitors' climatic preferences, gleaned from a variety of surveys conducted over the past decade. This feature has overcome the key limitation of the TCI because the design of the HCI is not subjective, and it has been empirically tested in the tourism marketplace. At present, several studies have been carried out to investigate and compare the validity of the TCI and HCI in tourism demand studies. Scott et al. (2016) employed both the TCI and HCI to investigate their impacts on tourism demand in Europe. In the meantime, Ruddy et al. (2020) conducted a similar study to compare the impacts of the TCI and HCI on tourist arrivals in the Caribbean. Both studies concluded that the HCI is relatively accurate and performed better than the TCI. To better validate the climatic impact on the tourism industry in Malaysia, this study aims to employ the TCI and HCI to investigate the climatic impact on the tourism demand in Malaysia. This research is significant because while previous studies have focused mainly on four-season countries, Malaysia is considered a no-season country, and the empirical outcome of this study will contribute to the limited body of research on the tourism industry in Malaysia.

Methodology

Malaysian tourism was chosen in this study because of its primary importance to the Southeast Asia region and tourism's socio-economic contribution to the Malaysian economy. Given the critical concern about climate change under SDGs, this study employs the TCI designed by Mieczkowski (1985) and the HCI constructed by Scott et al. (2016) to investigate the climatic impacts on the tourism industry in Malaysia. The empirical outcomes of this study can provide scientific support for the long-term sustainable growth of the tourism industry in Malaysia. The monthly climatic data such as temperature, humidity, precipitation, duration of sunshine, cloud cover and wind speed spanning from 2010 through 2020 were collected from the website The Weather Online. Meanwhile, the number of tourist arrivals from ten major tourist-generating countries in Malaysia were gathered from the Department of Statistics Malaysia. This paper is theoretically based on human biometeorological aspects to reflect humans' thermal comfort. The thermal comfort index is computed by using the effective temperatures based on the ASHRAE-55 standard. The TCI was constructed by integrating several climatic indexes into a single numerical index to present the climatic conditions in Malaysia as shown below:

$$TCI = 2 \times (4CID + CIA + 2P + 2S + W) \quad (1)$$

where *CID* refers to the daytime comfort index by combining the maximum daily temperature (°C) and minimum daily relative humidity (%); *CIA* proxies the daily comfort index, which is a combination of mean daily temperature (°C) and mean daily relative humidity (%); *P* refers to precipitation level (mm); *S* indicates the duration of sunshine (hours); and *W* is the wind speed (km/h or m/s). Table 2 shows that the weightages of the TCI assigned to each sub-index is based on the weightage constructed by Mieczkowski (1985).

Table 2: Weightage of TCI and HCI

Facet	TCI		HCI	
	Sub-index	Weightage	Sub-index	Weightage
Thermal	Daytime Comfort Index	40%	Daytime	
Comfort	Daily Comfort Index	10%	Temperature	40%
Physical	Precipitation	20%	Precipitation	30%
	Wind	10%	Wind	10%
Aesthetic	Hours of Sunshine	20%	Cloud Cover	20%

Sources: Mieczkowski (1985) and Scott et al. (2016).

Thermal comfort comprises half of the TCI’s weightage, followed by the physical facet (30%), and the aesthetic (20%) as shown in Table 2. Each sub-index was assigned with the highest score of 5.0, making a maximum score of 100 to indicate the ideal climatic conditions, and the score of -30 reflects impossible climatic conditions (see Table 3).

Table 3: Classification Scheme for TCI and HCI

TCI		HCI	
Score	Descriptive Category	Score	Descriptive Category
$90 \leq TCI \leq 100$	Ideal	$90 \leq HCI \leq 100$	Ideal
$80 \leq TCI \leq 89$	Excellent	$80 \leq HCI \leq 89$	Excellent
$70 \leq TCI \leq 79$	Very good	$70 \leq HCI \leq 79$	Very good
$60 \leq TCI \leq 69$	Good	$60 \leq HCI \leq 69$	Good
$50 \leq TCI \leq 59$	Acceptable	$50 \leq HCI \leq 59$	Acceptable
$40 \leq TCI \leq 49$	Marginal	$40 \leq HCI \leq 49$	Marginal
$30 \leq TCI \leq 39$	Unfavorable	$30 \leq HCI \leq 39$	Unacceptable
$20 \leq TCI \leq 29$	Very unfavorable	$20 \leq HCI \leq 29$	Unacceptable
$10 \leq TCI \leq 19$	Extremely unfavorable	$10 \leq HCI \leq 19$	Unacceptable
$-30 \leq TCI \leq 9$	Impossible	$0 \leq HCI \leq 9$	Dangerous

Meanwhile, Scott et al. (2016) designed the HCI by incorporating a few climatic variables into three facets: thermal comfort (*TC*), aesthetic (*A*), and physical (*P*) into a single numerical index. *TC* is a combination of daily maximum temperature (°C) and mean relative humidity (%); *A* refers to cloud cover (%); and *P* is the combination of precipitation (mm) and wind speed (km/h). In this paper, the weightage of each sub-index in HCI is following the construction of Scott et al. (2016) as shown in Table 2. Equation 2 shows the computation of the HCI:

$$HCI = 4(TC) + 2(A) + [3(P) + W] \tag{2}$$

Each sub-index is rated on a scale of 0 to 10 to obtain a score range between 0 (potentially dangerous for tourists) and 100 (ideal tourism climate) as shown in Table 3. Unlike the TCI, the thermal comfort of the HCI is given equal weight of 40% to the physical facet to ensure that a high score for the HCI cannot be achieved when the physical index rating is low. Besides that, the aesthetic facet in the HCI uses cloud cover instead of sunshine due to data availability in the later time from the standard meteorological stations (Scott et al., 2016). For a fair comparison, each sub-index of the TCI and HCI will be rated on a scale between 0 and 10 to obtain a score range between 0 and 100. To better validate the accurate rating of both TCI and HCI, this

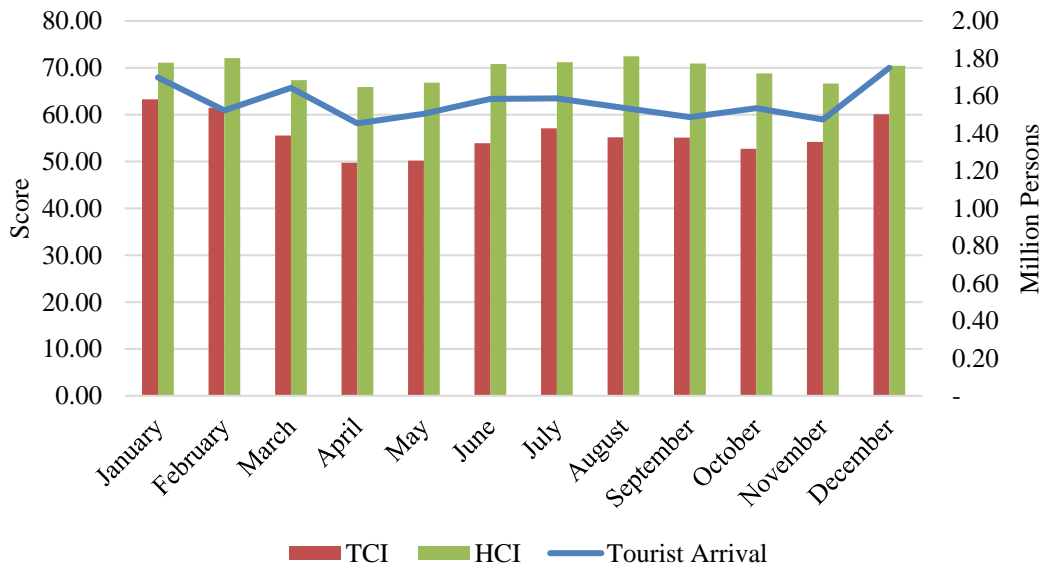
study will compare both means monthly scores of TCI and HCI with the average monthly international tourist arrivals at Malaysia to evaluate their validity in Malaysian tourism market.

The ideal climatic condition rated by TCI and HCI signifies that all three facets are regarded as being at the most satisfactory level by most tourists. Meanwhile, the climate categories ranked excellent and “Very good” still have some facets ranked highest by the tourists. Besides that, a range score below 40 is deemed “Unacceptable” for the HCI while the TCI ranked them as “Unfavorable”, “Very unfavorable”, and “Extremely unfavorable”. In addition, the TCI rated a score range below 9 as impossible but the HCI does not consider any climatic condition as “Impossible” because some tourists intentionally seek for extreme weather conditions such as high winds for wind surfing and storm watching. Thus, Scott et al. (2016) categorized this type of climatic condition as dangerous, and it rarely lasts for more than one or two days.

Results

Figure 1 illustrates the mean scores of the TCI and HCI with average monthly international tourist arrivals spanning from 2010 to 2020 in Malaysia. The empirical results illustrate that both mean scores of the TCI and HCI display similar trends with the mean international tourist arrivals in Malaysia.

Figure 1: Comparison of the Mean Scores for the TCI and HCI with Average Monthly Tourist Arrivals in Malaysia, 2010-2020



In the month of April, the scores of TCI and HCI are on average at their lowest point during the year which is in line with the lowest number of international tourist arrivals visited to Malaysia (see Figure 1 and Table 4). In addition, the scores for the months of May, September, and November are also relatively low as compared to other months of the year which are consistent with the lower number of international tourists that visited Malaysia in these few months. In the meantime, the most popular months to visit

the Malaysia are January and December based on the average monthly international tourist arrivals data. In fact, the TCI and HCI scores for these two months are also relatively high than other months. These findings indicate that the international tourists tend to visit to Malaysia when the country is experiencing the most comfortable climate conditions. Bausch et al. (2019) and Scott et al. (2008) also mentioned that the climate condition is one of the key considerations of the tourists prior or during their trip. Thus, the climatic condition in Malaysia is potentially influencing the travel decision of the tourists to Malaysia.

Table 4: Comparison of Average Monthly Scores for the TCI and HCI with Mean Monthly Tourist Arrivals in Malaysia, 2010-2020

Month	Tourist Arrivals	TCI		HCI	
	Persons	Score	Rating	Score	Rating
January	1,699,041	63.27	Good	71.09	Very Good
February	1,523,105	61.45	Good	72.09	Very Good
March	1,642,830	55.55	Acceptable	67.36	Good
April	1,453,599	49.73	Marginal	65.91	Good
May	1,505,222	50.18	Acceptable	66.82	Good
June	1,583,953	53.91	Acceptable	70.82	Very Good
July	1,586,781	57.09	Acceptable	71.18	Very Good
August	1,536,139	55.18	Acceptable	72.45	Very Good
September	1,487,250	55.09	Acceptable	70.91	Very Good
October	1,534,862	52.73	Acceptable	68.82	Good
November	1,474,369	54.18	Acceptable	66.64	Good
December	1,750,302	60.09	Good	70.45	Very Good

Although both the TCI and HCI display similar trends, the scores of the HCI are comparatively higher than that of the TCI. Table 4 shows that most of the months under the computation of TCI score below 60, however, none of the months in HCI calculation scored less than 60. In addition, all months in HCI are higher than the score 60 while only three months have scores more than 60 in TCI which are January, February, and December. Furthermore, Table 5 shows the percentage of climate conditions in Malaysia based on the mean scores of TCI and HCI from 2010 to 2020. According to the calculation of TCI, the majority of months (75.0%) are ranked as “Marginal” and “Acceptable” while none of the months fall into these categories under the measurement of the HCI. In addition, only three months are categorized as “Good” climatic condition but none of the month throughout the year ranked as “Very Good” climatic condition by TCI. Meanwhile, HCI ranked all climatic conditions in Malaysia as “Good” (41.7%) and “Very good” (58.3%) categories. One of the main reasons the TCI scored relatively low than the HCI is because the TCI overemphasized on thermal comfort, which weighted half of the index, as argued by Scott et al. (2016). Consistently, a few studies such as Ruddy et al. (2020) and Scott et al. (2016) also found out that the score rating of HCI is higher than TCI.

In sum, both the TCI and the HCI validated those climatic conditions are a key factor affecting tourists’ decision to visit Malaysia. Therefore, the government and key tourism industry players need to design a variety of tourism products to attract tourists

to Malaysia to maximize their travel experience. The empirical outcomes of this study provide useful information regarding the linkage between climatic conditions and tourism demand in Malaysia. Since climate is one of the critical concerns of the UNWTO, this study outlines the climatic impacts on the Malaysian tourism industry. Therefore, the government and key industry players need to urgently consider climate in their tourism planning as it closely relates to the tourism industry. Therefore, both government and key industry players need to work closely to design various feasible tourism plans to achieve long-term sustainable growth of tourism in Malaysia.

Table 5: Percentage of Climate Conditions in Malaysia, 2010-2020

Climate Condition	TCI		HCI	
	Month	Percentage	Month	Percentage
Marginal	1	8.3%	0	0.0%
Acceptable	8	66.7%	0	0.0%
Good	3	25.0%	5	41.7%
Very Good	0	0.0%	7	58.3%
Total	12	100.0%	12	100.0%

Conclusion

This study aims to investigate the impact of climate on tourism demand in Malaysia. To date, there are very limited studies employing the TCI and HCI to validate the impact of climatic conditions on tourism demand in Malaysia. Both indexes integrate several climatic variables such as temperature, duration of sunshine, precipitation rate, humidity, and other climatic variables into a single numerical number to reflect the climate conditions in Malaysia. This study has identified that both the TCI and the HCI display the similar trends regarding international tourist visitation patterns in Malaysia. The empirical findings show that the climatic condition in month of April is ranked as the lowest month by both the TCI and HCI, and, not surprisingly, Malaysia received the lowest number of international tourist arrivals in April. Meanwhile, more international tourists visit Malaysia in the months of January and December than in any other months, which aligns with the high scores of the TCI and the HCI for these few months. The empirical findings of this study suggest that, in general, the climatic conditions are significantly influencing tourism demand in Malaysia.

Implications and Future Research Direction

Understanding the tourists’ preferences is an utmost important to ensure the long-term sustainable growth of the tourism industry. With the support of key findings in this study, the government and the key tourism players can design a series of tourism products and activities in different periods especially during the months that are rated as “Good” and “Very good”. Identifying the months with preferable climatic conditions can have a greater implication to the whole tourism industry as well as the supporting key industry players. In addition, the stimulus plans and promotion packages offered by the government and industry players play the crucial role in attracting more tourist arrivals to visit to Malaysia. The government and tourism key players can design

specific tourism advertisements and activities that align with the climatic preferences. Besides that, the pricing strategy is also playing a crucial role in enhancing the tourism competitiveness and the attractiveness of the tourism destinations. The Malaysian government can offer various promotions in different time periods throughout the year to attract different tourist groups.

A significant tourism plan will bring a huge multiplier effect to the tourism industry chain especially the transportation industry, accommodation industry, food and beverages industry, travel agency and other downstream industries. Therefore, the government and key industry players need to evaluate tourism destinations that meet the climatic needs of tourists to ensure significant tourism implications for the long-term sustainable growth.

Further research is needed to fully understand the implications of the climatic impact on the tourism demand in Malaysia. Future study needs to employ different types of research techniques to validate the impact of climate condition on the tourism industry in various perspectives. In addition, distinct groups of tourists have different preferences on the climate condition of their travel destination. Some tourists are looking for comfortable and warm climatic conditions during their trip. However, some travelers search for extreme climatic conditions for extreme activities such as wind surfing or skydiving. A detailed study is needed to focus on the different groups of tourists to gather a more comprehensive findings on their preference and demand, and thus the government and policy players can design feasible tourism policies to attract different groups of tourists. Besides that, the climatic variables and non-climatic variables are key factors in influencing tourists' travel decision. Lastly, the impact of COVID-19 pandemic is crucial in future studies because the tourism industry and other industries have already been tremendously in various levels around the globe.

Practical Implications for Asian Business

In the past decades, many countries foresee great potential of the tourism industry in fostering economic development, creating jobs, and as a foreign exchange earner for the country, and thus countries extensively developed the tourism industry in the past. The world tourism industry enjoyed a strong momentum and robust growth of tourism revenue and arrivals which is fueled by stronger income growth of the tourists, expansion of the airline industry, ease of travel visa and other tourism expansion policies. Among the regions, the Asia Pacific region is one of the largest tourism contributors to the world tourism industry. Under the 2030 Agenda for Sustainable Development, climate is one of the key elements focused by the member countries. A balanced socio-economic development is a fundamental goal for sustainability growth in the long run. Sustainable growth in the tourism industry has been long discussed, and climate is one of its core challenges. Climate plays a special role in influencing the tourists' motivation. The climatic condition can be a push factor in motivating the tourists to travel abroad. Therefore, the tourists' travel decision is not only motivated by the macroeconomic variables: the income level, exchange rate and other macro variables, but it is also influenced by the climatic variables.

Malaysia is one of the famous tourism destinations in Asian countries. The present study focuses on the climatic impacts on the Malaysian tourism industry. Our study

employed the TCI and the HCI to validate climatic impacts on tourism demand in Malaysia. Both indexes integrate several climatic variables such as temperature, duration of sunshine, humidity, and other key climatic variables into a single numerical number to reflect the climatic conditions. The findings evidenced that climate condition and tourist arrivals are having similar trends. Malaysia is a tropical climate country and there is relatively seasonal variability throughout the months in a year. Malaysia experiences hottest months in the mid of the year, and higher rainfall during the end of the year. This is mainly influenced by the Southwest Monsoon and Northwest Monsoon sessions. The months with higher rainfall and hotter temperature will affect the outdoor tourism activities during these periods. As evidence in this study, April, and May (the hottest season), and November (rainfall season) receive fewer tourist arrivals in Malaysia. This indicates that the climate condition is potentially affecting the tourism industry in Malaysia.

The empirical findings of the present study can serve as a reference for the government and policy practitioners in the Asian countries to focus more on the impact of the non-macroeconomic variables toward the demand of the tourism industry. Since the climatic condition has a significant implication to the Malaysian tourism industry, it is believed that the climate condition is also potentially influencing the tourism demand in other Asian countries. The government and tourism policy makers can design various types of tourism activities in different months throughout the year to attract different segments of the tourist groups. During the raining and hot seasons, the industry players can promote indoor activities with various promotion campaigns such as mega sales to attract them to shopping within the Asian countries. In a nutshell, continuous research is needed to ensure the long-term sustainable growth of the tourism industry in the Asian countries.

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