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# **Does biodiversity matters in the tourism demand model? International evidence**

## **Será que a biodiversidade importa na procura turística? Evidência internacional**

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### **Abstract**

This study examines the role of natural attractions, measured by biodiversity, in drawing international tourists. This study examines a global sample of 120 countries from 2010 to 2016. Several static approaches such as Pooled Ordinary Least Square (POLS), Random Effect (RE) and Fixed Effect (FE) models were used to estimate the static effect between biodiversity and international tourist arrivals. The robust standard error results show that the choice of a tourism destination is strongly related to biodiversity. The results also indicate that GDP per capita, good governance, investment in the travel and tourism sector, and the internet are positively significant in determining tourism demand.

*Keywords:* Tourism, Environment, Biodiversity, International Tourist Arrival, Economics

*JEL Classification:* C50, F00, O11, Q01, Q50

### **Resumo**

Este estudo examina o papel dos atrativos naturais, medidos pela biodiversidade, na atração de turistas internacionais. Foi realizado entre 2010 e 2016 para 120 países. Várias abordagens estáticas, como Pooled Ordinary Least Squares (POLS), Random Effects (RE), bem como Fixed Effects (FE), foram usadas para estimar o efeito estático entre a biodiversidade e as chegadas de turistas internacionais. No geral, os resultados robustos obtidos em matéria de erro padrão mostram que a escolha de um destino turístico está fortemente relacionada com a biodiversidade. Além disso, os resultados também revelam que o PIB *per capita*, a boa governança, o investimento no setor de

viagens e turismo, bem como o uso da internet são positivamente significantes na explicação da determinação da procura turística.

*Palavras-chave:* Turismo, Ambiente, Biodiversidade, Chegada de Turistas Internacionais, Economia

*Códigos JEL:* C50, F00, O11, Q01, Q50

## 1. INTRODUCTION

The tourism sector is a growing industry that contributes to economic development. Tourism can be defined as “the collection of activities, services, and industries that delivers travel experience including transportation, accommodation, eating and drinking establishments of retail shops, entertainment, business, and other hospitality services provided for individuals or groups that travelling away from home” (Dayananda, 2014, p.1). The tourism sector ranks as the third export sector in the world and the main export sector in developing countries (UNWTO, 2017). In the recent decade, the number of international tourist arrivals has experienced a continual growth with 956 million tourists, and it rose to 1.2 million tourists in the year 2014. Irrespective of various obstacles, the number of arrivals in 2017 was remarkable with more than 1.3 billion tourists (WTTC, 2019).

Other than contributing to foreign exchange earnings, tourism also plays a vital role in stimulating higher gross domestic product (GDP) and creating more job opportunities due to its diversity. In 2017, there were about 311,703 jobs created by the travel and tourism industry and it is also expected to create about 400,327 jobs at the global level in just a decade (WTTC, 2019). Moreover, an increase in arrivals leads to better economic performance in a destination country through tourist spending and revenues generated by the travel and tourism related industries such as hotels, restaurants, travel agents, airlines and transportations business services. This consequently brings prosperity to both developed and developing countries.

Tourism is a well-known and effective way for people to explore the world, create new experiences, network with other people around the globe, and help gain new knowledge. Therefore, a conventional international tourism demand model goes beyond income and tourism prices, and that includes the cost of transportation, exchange rates, demographic factors (life expectancy, ageing population and educational level), natural heritage, environmental condition (CO<sub>2</sub> emission), and road facilities (Lim, 1997; Johnson & Ashworth, 1990; Lohmann & Danielsson, 2004; Cho, 2010).

Although the factors that lead to an increase in tourism demand are well studied, the fundamental question on what factors attract a higher number of international tourist arrivals in destination countries needs to be further explored. For instance, Europe receives the largest number of international tourist arrivals of 620 million in 2016, followed by Asia and the Pacific (303 million), The Americas (201 million), Africa (58 million) and Middle East (54 million) but little is understood with regards to the driving forces behind the visitations. This information is crucial for policymakers to formulate policies that will help attract tourists and to increase repeat visitation to holiday destinations.

Since most of the previous tourism studies put too much attention on tourism demand variables, less studies have been found to be focusing on pull factors offered by a tourism destination that could attract higher number of international tourist arrivals. Thus, this study attempts to address this issue by including the “biodiversity” variable that acts as a supply factor or natural attraction in the tourism model for 120 countries from year 2010 to 2016. This is due to the fact that the attractiveness of a destination country does not only provide enjoyment but also offers a pre-taste of the destination to tourists. The paper is organized as follows. The next section discusses the literature related to tourism and section 3 provides the empirical model and methodology. The results are presented in section 4 and the last section concludes the study.

## 2. LITERATURE REVIEW

Other than considering economic variables - income, tourism prices, cost of transportation and exchange rates, (for example Lim, 1997; Johnson & Ashworth, 1990), there are also non-economic factors that important in explaining tourism demand. Lohmann and Danielsson (2004) reveal that the trend of travellers may not just decrease due to age factors, but also most of them “stick to the holiday patterns acquired till the middle of their life”. In considering demographic factors such as population, Cho (2010) listed out other variables that enhance the tourism demand by travellers, which includes cultural and natural heritage, environmental condition (CO<sub>2</sub> emission), road facilities, and other non-economic factors. On the other hand, poverty, diseases, lack of tourism facilities (e.g., accommodation), low public health quality service as well as public safety (Kester, 2003; Gauci et al., 2002) will reduce the demand for tourism.

The standard tourism demand model is derived from the classical framework of consumer demand theory by consuming commodity (traveller destination) that possesses certain characteristics that generate utility for consumers (travellers). However, Rugg (1973) argued that a traveller does not derive utility from consuming his/her travel destination, but rather obtains it from staying in a particular destination for a period of time and enjoying the attributes of the destination. For instance, in the previous studies, Evans and Nettleship (1985), Cepeda and Cruz (1994), and Enzenbacher (1994) found that explosive breeding of seabirds, active behaviour of the birds during the day, and laying eggs and sheltering the young ones in remote and attractive coastal environments have led to higher number of tourists in Galapagos Islands, Antarctica, and Canada. Kerley et al. (2003) revealed that biodiversity is the main attraction and contributing factor for high tourist visitation in South Africa. The study reported that the main attractions are elephant visitation, which accounts more than 70% of visitation reasons, followed by scenery (37%) and bird watching (17%). Similarly, Uyarra et al. (2005) found that all environmental attributes consisting of coral diversity, coral cover, coral health, fish diversity, fish abundance, the existence of sea turtle, bird diversity, landscape attractiveness, and water show a positive relationship with tourist enjoyment in Caribbean islands.

In a study led by the Conservation International (CI) and United Nations Environment Programme (UNEP), Christ et al. (2003) stated that nature and adventure tourism have burgeoned starting from the mid 1990s due to the attractiveness of the existing biodiversity. According to Freytag and Vietze (2009), biodiversity richness in a particular destination choice could stimulate tourism demand by acting as a direct influencing factor for sight-seeing activities and an indirect influencing factor for “nice nature”. A study by Remsen et al. (2016) proved that the largest bird diversity in Colombia has attracted a higher number of international tourist arrivals which consist of mainly people from the United States. Similarly in Uganda, the number of bird species is important to increase the attractiveness of protected areas and contribute to nature-based tourism (Naidoo & Adamowicz, 2005).

Earlier, Sobhee (2006) studied the relationship between fisheries biodiversity and tourism in Mauritius 1976 to 2000. The result of Shannon's entropy index shows that the richness in fish stock is associated with higher tourist earnings. Apart from getting attracted to the fisheries biodiversity, the abundance of flora and fauna, coupled with a beautiful scenic view of unique coral reefs and living resources of its lagoon become the primary attractions among travellers. Based on the statistic given in this study, the international tourist arrivals were about 600,000 people which is nearly half of the Mauritius population. This study also concludes that promoting fisheries biodiversity is essential to ensure the sustainability of the tourism sector.

Likewise, a study in the least developed countries (LDC) by Freytag and Vietze (2009) also proved that biodiversity richness in a particular destination choice could stimulate the tourism sector. The study used the number of birds living (and breeding) to measure biodiversity for the independent variable and inbound tourism receipts per capita as the dependent variable. The study employs the simple Ordinary Least Square (OLS) test and the results proved to be highly significant at 1% significant level. In contrast, by using the ratio of endangered birds to all birds, on-going biodiversity losses will reduce the number of inbound tourism receipts. Therefore, this study aims to prove that the presence of biodiversity could act as a channel to have better economic growth through sustainable tourism which can lead to economic convergence from the Least Developed Countries (LDCs) to Developed Countries in the future. Arbieu et al. (2017) also reveals that higher presence

of large mammals will increase tourism demand. Coupled with highly significant p-value (0.001), an increase in 1% biodiversity supply leads to 28% increase in tourism demand.

On the other hand, the role of destination attractions in increasing the number of international tourist arrivals also have been discussed in the previous studies by using several biodiversity loss measurements. For instance, in Africa, the number of threatened species including mammals, birds, reptiles, amphibians, fish, corals and a small number of insects, snails, ferns and flowing plants plays a major role in attracting a higher number of tourist arrivals (Willemen et al., 2015). Similarly, the number of threatened species is also used by Siikamäki et al. (2015), to measure the biodiversity loss in protected areas, which is located in Finnish national parks (NPs), Finland. The variables included were taken from the HERTTA database of the Finnish Environment Institute and all species included in this study are considered to be either critically endangered, endangered, vulnerable, or near threatened. The GLM method was performed and the reported outcome shows a positive relationship between the number of visitation and biodiversity loss.

Cong et al. (2014) conducted a study in China reported that wildlife tourism experience with endangered species was found to be higher among international tourists. The thematic analysis qualitative method was used to examine tourist interactions with giant pandas (*Ailuropoda melanoleuca*), at the Chengdu Research Base of Giant Panda Breeding (CRBGPB) in Sichuan, China. The study samples were collected from April 17 to April 23, 2012 from a number of websites including TripAdvisor, TravelPod, TripBlog, Lvping, and Sina with the keywords of Chengdu Research Base of Giant Panda Breeding. Since giant pandas are classified as highly endangered, encountering this species provided the highest level of satisfaction among the tourists.

Likewise, Ethiopian wolf (*Canis simensis*) also act as the most valuable attraction among international tourists in Ethiopia's Bale Mountains National Park. This study was conducted by Estifanos et al. (2021) using random parameter logit model. Given its status as an endangered species, the willingness to pay results also show that tourists were willing to pay up to US\$5.82/day/trip if the wolf population increase from 200 to 250. This study also concluded that growing ecotourism sector in this area might be due to the wolf's existence value.

Cazabon-Mannette et al. (2017) used choice experiment to study travelling preferences among international tourists in Tobago between July 2007 and November 2010. They examined the preferences of 172 scuba divers with regards to several endangered species proxies such as turtle encounters, fish, and coral cover. The majority of the tourists were from the UK (46%), Europe (27%), and U.S (20%). The results from conditional logit and mixed logit models show that turtle encounter coefficient was highly significant among other attributes at 1% level. The outcome of this study indicates that turtle encounter was the most important attribute although the species is suffering from extinction issue.

In Colombia, bird watching tourism is a popular attraction among international tourists. The country is reported to have 79 endemic species, 193 near endemic and 139 threatened species, and bird tourism is considered among the activities with high growth prospects within its nature-based tourism sector. A pilot survey was conducted where 236 respondents were included in a study of bird-based tourism in Colombia. Tourist willingness to pay was also examined using the Contingent Valuation (CV) approach. Overall, the demand for bird watching was found to be higher among the international tourists and they were willing to pay more than the average bird watching price in Costa Rica. Maldonado et al. (2018) also reported in their study that other than Colombia, Costa Rica, Canada, Mexico and Ecuador are also the most countries visited by the respondents (47 per cent) and more than 60 percent of future travellers were planning to visit those countries for the purpose of bird watching.

Next, a positive relationship between biodiversity and tourism could be also seen in the case of the whale shark in South Ari Atoll, which is known as the largest marine protected area in the Republic of Maldives. Instead of relying on the traditional method such as survey, Cagua et al. (2014) utilizes empirical data, where tourist expenditure and the number of tourists in year 2012 and 2013 were used as tourism measurements. Both GLS and GLM tests showed that whale shark tourism has attracted 72,000 to 78,000 visitors per year with mean direct tourist expenditure of US\$7.6 and \$9.4 million. This study also concluded that whale shark tourism was viewed as an important wildlife tourism industry in the country since it contributes to 3% of the global shark ecotourism expenditure, coupled with US\$457,200 (2012) and US\$748,800 (2013) annual revenues generated from this industry.

A global study between biodiversity and nature-based tourism in 929 protected areas was conducted by Chung et al. (2018) using aggregated data from 2000 to 2014. The main focal independent variables selected in this study are the management strategy that was used at the protected areas and biodiversity. In this study, biodiversity is defined as the number of birds, animal, and amphibian species found inside the protected areas. The multiple regression outcome showed that 1% increase in biodiversity will increase tourist arrivals by 0.87%. The result indicated that biodiversity is one of the major influences in enhancing the tourism sector. Furthermore, management strategies were also found to be important where the protected areas that were predominantly managed for biodiversity conservation received roughly 1.35 times the number of visits than those managed for mixed use.

A study by Din et al. (2019) reported a positive correlation between biodiversity loss (measured by forest area, protected areas, and number of fish species threatened) and the number of international tourist arrivals. The cross-sectional study of 107 countries, conducted in 2003 using OLS approach also highlighted the importance of conserving the environment as it helps to boost the tourism sector and other related industries.

### 3. METHODOLOGY

#### 3.1 The Estimating Model

The tourism demand model in this study is adapted from Freytag and Vietze (2009), Din et al. (2017), and Din et al. (2019), which is identified as follows:

$$\text{tourist arrivals} = f(\text{biodiversity, GDP per capita, exchange rate, capital, internet, life expectancy, governance}) \quad (1)$$

All the variables are transformed into a log-linear form. The log-linear form is more popular due to its association with elasticities and superior empirical results compared with the corresponding linear functional form (Artus, 1970; Barry & O'Hagan, 1972; Uysal & Crompton, 1984; Johnson & Ashworth, 1990; Crouch, 1994). Therefore, the estimated model is represented as follows:

$$l\text{touristarrivals}_{it} = \beta_0 + \beta_1 lbiodiversity_{it} + \beta_2 lgdppercapita_{it} + \beta_3 lexchangerate_{it} + \beta_4 lcapital_{it} + \beta_5 linternet_{it} + \beta_6 llifeexpectancy_{it} + \beta_7 lgovernance_{it} + \varepsilon_{it} \quad (2)$$

where  $l\text{touristarrivals}_{it}$  equals international tourist arrivals in country  $i$  at time  $t$ , a proxy for tourism demand,  $lbiodiversity_{it}$  equals the number of threatened species for country  $i$  at time  $t$ , a proxy for biodiversity,  $lgdppercapita_{it}$  equals gross domestic product per capita in country  $i$  at time  $t$ , a proxy for income,  $lexchangerate_{it}$  equals real effective exchange rate in country  $i$  at time  $t$ , proxy for the exchange rate,  $lgovernance_{it}$  equals governance indicator for safety guarantee in the destination country  $i$  at time  $t$ , a proxy for the government quality,  $lcapital_{it}$  equals the growth in government expenditure on travel and tourism services in destination country  $i$  at time  $t$ , a proxy for tourism capital,  $linternet_{it}$  equals fixed broadband subscriptions in the destination country  $i$  at time  $t$ , a proxy for internet availability, and  $llifeexpectancy_{it}$  equals the life expectancy of a newborn in country  $i$  at time  $t$ , a proxy for health conditions. It is expected a priori that,  $\beta'_s > 0$ ; and the error term is assumed to have zero mean and constant variance.

In this study, we use the number of international tourist arrivals, which is consistent with most of the previous studies on international tourism demand analysis (Song et al., 2003; Dritsakis et al., 2004; Chan et al., 2005; Naudé & Saayman, 2005; Anggraeni, 2017; Din et al., 2017). As for the independent variables, the traditional model suggests that the tourism demand mainly depends on income and the price of tourism. This study uses GDP per capita that acts as a pull factor in attracting international tourist arrivals as highlighted by Anggraeni (2017). A higher GDP per capita reflects a wealthier nation that can provide better facilities and infrastructures including transportation system, water and electricity supply system, communication facilities, tourism related facilities and many more. The exchange rate variable is also included in this study since the impact of exchange rate in determining tourism demand seems to have a similar impact as tourism prices (Webber, 2001), which is commonly referred as the price of goods and services consumed in a tourism destination.

Next, this study extends the base model by including biodiversity as a focal variable. According to Leiper (1979, p.397), “tourist destination regions can be defined as locations that attract tourists to stay temporarily and contain features which inherently contribute to that attraction”. This means that the geographical characteristic or features of those places can bring more tourists to experience them personally as well as to get enjoyment while travelling. Previous studies have shown that growing tourism is associated with the presence of biodiversity (Cepeda & Cruz, 1994; Enzenbacher, 1994; Kerley et al., 2003; Uyerra et al., 2005; Lindsey et al., 2007; Anderson et al., 2011; Cagua et al., 2014; Maldonado et al., 2018; Din et al., 2017; Din et al., 2019; Estifanos et al., 2021).

However, measuring biodiversity can be very challenging as the scope of biodiversity is very wide. Hence, following Din et al. (2019), this study tries to limit the scope by using biodiversity loss, measured using the number of threatened species (mammals, birds, reptiles, fishes, and plants) to proxy for species and habitat diversity. In other words, the more endemic, rare species, native, pristine, inherent or an exhibited natural value, historical significance and natural or built beauty, the higher the possibility of the tourism destination to be chosen. Tourists seek to travel to another country to find uncommon species which cannot be found in their home country. It becomes valuable since the tourist assumes that this species cannot be sustained in the future. Therefore, it is vital to develop an in-depth understanding of a global assessment between endangered species and tourism demand.

Encountering with endangered species has also been long recognized as a main attraction in the tourism context. The existence of endangered species not only provides enjoyment, but it also stimulates psychological entertainment for the tourist. Realizing the importance of endangered species in boosting the tourism sector, variety of methods have been implemented to conserve these species<sup>1</sup>. Hence, the role of endangered species, especially in protected areas could be an additional source of income for the local economy. It will not only attract international attention to preserve a tourism destination, but also conserves natural resources and the environment as it encourages pro-environmental behaviors (Bozhko et al., 2021).

Furthermore, tourism would be unsuccessful without the presence of tourism related facilities. These facilities are important as they are able to affect tourists’ satisfaction and their travel decisions (Khan et al., 2017; Mandić et al., 2018; Das & Naskar, 2018). Considering this, government expenditure on travel and tourism is included as one of the explanatory variables in the tourism demand model. Other than that, internet plays an increasingly important role in promoting the tourism sector. It does not only help to share information and distribute tourism products efficiently and effectively (Hoonsawat, 2016; Hossain, 2020), but it also provides pre-trip and in-trip information for tourists across the world.

The shape of tourism demand could also be positively affected by favourable health conditions (Gauci et al., 2002; Anggraeni, 2017). For example, this study uses life expectancy, measured by the number of years, indicating a healthier population as life expectancy increases. It represents the external factor that could influence the tourists’ decision in selecting a tourism destination.

In general, good governance plays an important role to provide comfort, secure and safety trips for tourists (Steyn & Jansen van Vuuren, 2016; Habibullah et al., 2018; Tang, 2018). According to Kaufman et al. (2008), governance is defined as “the traditions and institutions by which authority in a country is exercised. This includes the process by which governments are selected, monitored and replaced; the capacity of the government to effectively formulate and implement sound policies; and the respect of citizens and the state for the institutions that govern economic and social interactions among them”.

There are six dimensions of governance that are included in the tourism demand model which are voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. This data is obtained from the World Governance Indicators (WGI), reported by the World Bank (a detailed documentation can be found in Kaufman et al., 2008). These indicators were constructed based on the responses received from the respondents, non-governmental organizations, commercial business information providers and public sector organizations worldwide on their perception of governance. The gathered data was converted into one aggregate indicator by using the linear unobserved components model.

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<sup>1</sup> Source: World Bank (2018), and website: <https://www.worldbank.org/en/news/feature/2018/03/01/growing-wildlife-based-tourism-sustainably-a-new-report-and-qa> (accessed on 31th October 2021).

The definitions of each indicators are as follows: (i) Voice and accountability: *measures perceptions of the extent to which a country's citizens are able to participate in selecting their government as well as the extent to which citizens can exercise freedom of expression, freedom of association, and freedom of media*; (ii) Political stability and absence of violence: *measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism*; (iii) Government effectiveness: *measures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies*; (iv) Regulatory quality: *measures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development*; (v) Rule of law: *measures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence*; and (vi) Control of corruption: *measures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests*.

#### 4. METHODS OF ESTIMATIONS

Panel static panel approach is being used in this study to examine the role of biodiversity as well as other theoretical and control independent variables in modelling the tourism demand. The test includes Pooled Ordinary Least Square (POLS), Random Effect (RE), and Fixed Effect (FE).

In the POLS approach, both the slope and intercepts are pooled for all units or in this case, countries. In other words, it is assumed that the slope and intercepts are the same across countries and time. Furthermore, tourism demand estimation is also assumed to have no significant countries or temporal effects. To capture those dimensions, this study employs FE and RE estimations, where each country is associated with its intercept and restricting the slope to be homogenous. Based on Equation (2), the error term can be decomposed into:

$$\varepsilon_{it} = \lambda_i + \mu_{it} \quad (3)$$

where  $\lambda_i$  represents time-invariant individual-specific effect,  $\mu_{it}$  refers to the remainder disturbance that varies across time and countries. The FE approach treats  $\lambda_i$  as constant, where it allows the correlation with explanatory variables. Meanwhile, the RE approach treats  $\lambda_i$  as independent that is drawn from some probability distribution, coupled with zero mean and zero correlation with explanatory variables. Therefore, based on Equation (2), the RE tourism demand model can be written as follows:

$$ltouristarrivals_{it} = \beta_0 + \beta_1 lbiodiversity_{it} + \beta_2 lgdppercapita_{it} + \beta_3 lexchangerate_{it} + \beta_4 lcapital_{it} + \beta_5 linternet_{it} + \beta_6 llifeexpectancy_{it} + \beta_7 lgovernance_{it} + \lambda_i + \mu_{it} \quad (4)$$

where the individual-specific effect is part of the error term. Meanwhile, the equation for the FE model is as follows:

$$ltouristarrivals_{it} = \beta_0 + \lambda_i + \beta_1 lbiodiversity_{it} + \beta_2 lgdppercapita_{it} + \beta_3 lexchangerate_{it} + \beta_4 lcapital_{it} + \beta_5 linternet_{it} + \beta_6 llifeexpectancy_{it} + \beta_7 lgovernance_{it} + \mu_{it} \quad (5)$$

The Breuch-Pagan LM (BPLM) test, developed by Breusch and Pagan (1980) was carried out to find the best estimation between POLS and RE estimators. If the  $H_0$  is rejected, then the RE model needs to be compared to the FE model using the Hausman test, developed by Hausman (1978).

#### 5. SOURCES OF DATA

The data sets used in this study are annual figures gathered from 2010 to 2016. The data for biodiversity are collected from the IUCN Red List. The data for international tourist arrivals, real GDP per capita (constant 2010 US\$), internet, and life expectancy are obtained from the World

Development Indicators. Besides that, the governance indicators are taken from the World Governance Indicators at the World Bank database while the real effective exchange rate (CPI-based) is obtained from the UNCTADSTAT.

## 6. RESULTS AND DISCUSSIONS

The outcome of this study is presented in Table 1. Based on the POLS estimations, all explanatory variables are highly significant, except for capital. This indicates that biodiversity, GDP per capita, exchange rate, good governance, internet, and life expectancy are essential in determining tourism demand. For example, in the case of our focal variable, with other variables being equal, a 1% increase in the number of threatened species leads to 0.2% increase in international tourist arrivals. Similarly, with other variables being equal, the number of tourists increases by 0.13%, 0.40% and 0.45%, with 1% increase in income, institutional quality, and the internet respectively.

On the other hand, the number of tourists reduces by 0.51%, with a 1% increase in the exchange rate, and this is consistent with the study by Khoshnevis and Khanalizadeh (2017), Lim and Zhu (2017), and Meo et al. (2018). This finding seems true as exchange rate fluctuation might affect tourist expenditure behaviour in a tourism destination. Although the adjusted  $R^2$  is 0.72%, in which 72% tourist demand can be explained by the predictor variables, the sign for the life expectancy parameter contradicts most of prior studies. These studies have proven that any tourism destinations should be associated with a favorable health condition to attract foreign tourists as presented in Gauci et al. (2002), and Anggraeni (2017).

The results provided by the RE model reveal that biodiversity is highly significant at 1% level. An increase in tourism demand is also strongly affected by GDP per capita (0.24%), better governance (0.58%), investment (0.01%) as well as internet (0.15%). However, the RE model also indicates that the exchange rate and life expectancy appears to be insignificant in determining the tourism demand.

Additionally, the rejection of the null hypothesis of the Hausman test shows that the FE model is favored compared to the RE model. Furthermore, checking for heteroscedasticity and cross-sectional dependence (CSD) are necessary since this study uses panel data analysis. The presence of CSD in the errors indicates a correlation between all units in the same cross-section due to the implications of influence, common shocks and unobserved common factors (Robertson & Symons, 2000). On the other hand, the issue of heteroscedasticity is a sign that shows the variance of the residuals is suffering from a non-constant trend. Since the presence of CSD and heteroscedasticity issues exist in the FE model, the robust standard error estimator is selected where it is corrected for the standard error of the previous FE results.

The robust standard error result shows, as expected, the means and purpose of travelling could be strongly related to biodiversity where a 1% increase in the number of threatened species leads to an increase in international tourist arrivals by 0.32%. The positive and significant outcomes are in line with the previous studies (e.g.: Naidoo & Adomowicz, 2005; Sobhee, 2006; Kerley et al., 2003; Freytag & Vietze, 2009; Uyarra et al., 2005; Cagua et al., 2014; Cong et al., 2014; Siikamä et al., 2015; Willemen et al., 2015; Arbiue et al., 2017; Maldonado et al., 2018; Din et al., 2019; Estifanos et al., 2021). Moreover, since biodiversity is measured using the number of threatened species, the result indicates that international tourists are highly attracted to endemic and rare species.

An increase in poverty and lack of tourism facilities can influence reverse on-going trend in the number of tourist arrivals. From Table 1, it is noticed that tourism demand is increased by 0.01% and 0.60% with a 1% increase in GDP per capita and government individual expenditure in the tourism sector. Therefore, an improved economic performance is essential as it may not only increase tourist satisfaction through infrastructures and facilities development (Khan et al., 2017; Mandić et al., 2018; Das & Naskar, 2018), but also increases per capita income.

Subsequently, the positive effect of the internet on tourism demand in this study does support its role as a medium of information exchange as highlighted by Hoonsawat (2016), and Hossain (2020). The insignificant result of the exchange rate in affecting international tourist arrivals is also consistent with the studies by Vanegas and Croes (2000), Quadri and Zheng (2010), and Tang et al. (2016). It substantiates the findings that any changes in the exchange rate will not affect tourist preferences to travel. On the other hand, although the coefficient of life expectancy is positive, it is also insignificant in explaining tourism demand.

The governance index, measured by regulatory quality also shows a positive sign and is highly significant at 1% level. This indicates that good governance is important in describing the safety of

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a particular country and therefore able to attract more international tourists to visit. International tourist arrivals will increase by 0.58% with a 1% increase in institutional quality. These positive effects are consistent with the findings by Steyn and Jansen van Vuuren (2016), Tang (2018), and Khan et al. (2020) that suggest tourists prefer a country with better governance in selecting their holiday destination.

**Table 1: Tourism demand and the environment using static approach**

Variables	Methods			
	POLS	Random Effect (RE)	Fixed Effect (FE)	Fixed Effect (FE) VCE Robust
Biodiversity <sub>it</sub>	0.2000*** (0.0285)	0.3761*** (0.0511)	0.3217*** (0.0771)	0.3217*** (0.0874)
GDP per capita <sub>it</sub>	0.1269*** (0.0433)	0.2385*** (0.0787)	0.6040*** (0.1893)	0.6040** (0.2967)
Exchange rate <sub>it</sub>	-0.5104*** (0.1543)	0.1142 (0.1116)	0.1515 (0.1118)	0.1515 (0.1278)
Capital <sub>it</sub>	-0.0058 (0.0148)	0.0134** (0.0052)	0.0125** (0.0050)	0.0125** (0.0058)
Internet <sub>it</sub>	0.4532*** (0.0176)	0.1516*** (0.0220)	0.0641*** (0.0240)	0.0641* (0.0354)
Life expectancy <sub>it</sub>	-2.211*** (0.4437)	0.6149 (0.6686)	1.8029** (0.7995)	1.8029 (2.1092)
Governance <sub>it</sub>	0.4028*** (0.0705)	0.5767*** (0.0979)	0.5785*** (0.1122)	0.5785*** (0.1863)
Constant <sub>it</sub>	18.530*** (1.7701)	5.5523** (2.4716)	-1.4979 (3.0707)	-1.4979 (7.7217)
$\bar{R}^2$	0.7190			
RMSE	0.8350			
BPLM Test	0.000			
Hausman Test		0.000		
Heteroscedasticity Test			0.000	
CSD Test			0.000	
Number of observations	831	831	831	831

Notes: Figures in the parentheses are standard errors.  $\bar{R}^2$  denotes as adjusted R-squared, RMSE denotes root mean square error, BPLM denotes Breusch–Pagan LM test, and CSD denotes cross-sectional dependence. All the BPLM test, Hausman test, Heteroscedasticity test, and CSD test are reported in p-values. \*, \*\*, and \*\*\* indicate 10%, 5%, and 1% significance levels.

Interestingly, another FE robust estimation is regressed and the results is presented in Table 1a. The sign of the estimated coefficient of the focal variable (biodiversity) remains unchanged even some of the insignificant independent variables in earlier findings, such as exchange rate and life expectancy are dropped in the model. Moreover, the other independent variables are also appearing to be highly significant and positively correlated with tourism.

**Table 1a: Tourism demand and the environment using FE robust approach**

Variables	Method
	<b>Fixed Effect (FE) VCE Robust</b>
Biodiversity <sub>it</sub>	0.3601***
	(0.0983)
GDP per capita <sub>it</sub>	0.7453***
	(0.2545)
Capital <sub>it</sub>	-0.0117**
	(0.0055)
Internet <sub>it</sub>	0.0874***
	(0.0314)
Governance <sub>it</sub>	0.5811***
	(0.1856)
Constant <sub>it</sub>	5.1929***
	(1.9573)
Number of observations	831

Notes: \*, \*\*, and \*\*\* indicate 10%, 5%, and 1% significance levels.

Besides the initial robust standard error findings provided in Table 2, other governance indicators such as government effectiveness, rule of law, voice accountability, control of corruption, and political stability were added as control variables to check for robustness. Interestingly, the biodiversity variable is highly significant at 1% for all governance indicators, affirming the robustness of the model.

**Table 2: Tourism demand and biodiversity model using static approach (with robust standard error), 2010-2016**

	Regulatory quality	Government effectiveness	Rule of law	Voice accountability	Control of corruption	Political stability
Biodiversity <sub>it</sub>	0.3217***	0.2880***	0.2808***	0.2757***	0.2832***	0.3194***
	(0.0874)	(0.0916)	(0.0868)	(0.0855)	(0.0873)	(0.0885)
GDP per capita <sub>it</sub>	0.6040**	0.6456**	0.6275*	0.7822**	0.7177**	0.5586*
	(0.2967)	(0.3673)	(0.3328)	(0.2982)	(0.3396)	(0.2983)
Exchange rate <sub>it</sub>	0.1515	0.2107	0.1784	0.1826	0.1783	0.1300
	(0.1278)	(0.1484)	(0.1353)	(0.1332)	(0.1362)	(0.1158)
Capital <sub>it</sub>	0.0125**	0.0126**	0.0146**	0.0135**	0.0130**	0.0115**
	(0.0058)	(0.0054)	(0.0064)	(0.0061)	(0.0057)	(0.0056)
Internet <sub>it</sub>	0.0641**	0.0554	0.0510	0.0534	0.0546	0.0292
	(0.0354)	(0.0383)	(0.0368)	(0.0380)	(0.0382)	(0.0388)
Life expectancy <sub>it</sub>	1.8029	1.8460	1.7414	1.6973	1.8737	2.7620
	(2.1092)	(2.2509)	(2.1067)	(2.1348)	(2.2381)	(2.4301)
Governance <sub>it</sub>	0.5785***	0.3472	0.4277*	0.0799	0.2598	0.2937***
	(0.1863)	(0.3293)	(0.2426)	(0.1325)	(0.2885)	(0.0921)
Constant	-1.4979	-2.0038	-1.1358	-2.3175	-2.5322	-4.5481

## Does biodiversity matters in the tourism demand model? International evidence

	(7.7217)	(7.9910)	(7.4856)	(7.9987)	(8.0048)	(8.8878)
Number of groups	120	120	120	120	120	120
Number of observations	831	831	831	831	831	831

Notes: \*, \*\*, and \*\*\* indicate 10%, 5%, and 1% significance levels.

For further robustness test, the analysis is conducted on the extended data (2010-2018). By employing robust static approach, the estimated regression suggests that positive relationship between tourism and biodiversity. The robustness results presented in Table 3 indicates that endangered species serve as one of the major factors in attracting a higher number of international tourist arrivals. In other words, on average, the results of this robustness test support the earlier findings of this study.

**Table 3: Tourism demand and biodiversity model using static approach (with robust standard error), 2010-2018**

	Regulatory quality	Government effectiveness	Rule of law	Voice accountability	Control of corruption	Political stability
Biodiversity <sub>it</sub>	0.2066*	0.1904*	0.1943*	0.2021*	0.1977*	0.2214*
	(0.1152)	(0.1147)	(0.1149)	(0.1140)	(0.1180)	(0.1162)
GDP per capita <sub>it</sub>	1.2650***	1.3414***	1.3282***	1.2946***	1.3289***	1.2325***
	(0.2500)	(0.2689)	(0.2757)	(0.2586)	(0.2746)	(0.2712)
Exchange rate <sub>it</sub>	0.1032	0.1222	0.1187	0.1178	0.1227	0.1048
	(0.1025)	(0.1030)	(0.1027)	(0.1029)	(0.1022)	(0.1019)
Capital <sub>it</sub>	-0.0003	0.0006	0.0005	0.0009	0.0005	0.0001
	(0.0050)	(0.0048)	(0.0049)	(0.0050)	(0.0049)	(0.0050)
Internet <sub>it</sub>	0.0196	0.0205	0.0196	0.0199	0.0196	0.0136
	(0.0243)	(0.0237)	(0.0243)	(0.0239)	(0.0238)	(0.0237)
Life expectancy <sub>it</sub>	3.8853*	3.7461*	3.7950*	3.8066*	3.7121*	4.2522**
	(2.0492)	(2.0830)	(2.1026)	(2.0832)	(2.0607)	(2.0369)
Governance <sub>it</sub>	0.2039	-0.0576	-0.0196	0.0806	-0.0952	0.2937***
	(0.1871)	(0.0931)	(0.0888)	(0.1464)	(0.1068)	(0.0921)
Constant	-14.6193	-14.6725	-14.7627	-14.5711	-14.4440	-15.8682
	(9.1274)	(9.5146)	(9.5281)	(9.3270)	(9.4873)	(9.4385)
Number of groups	120	120	120	120	120	120

Notes: \*, \*\*, and \*\*\* indicate the respective 10%, 5%, and 1% significance levels.

## 7. CONCLUSION

This research is conducted to study the relationship between the role of biodiversity that acts as a natural attraction in the tourism demand model. Based on the robust standard error outcome, the empirical results show that biodiversity appears to be very important to tourism and has become one of the main pillars of the sector. With other variables being equal, the number of international tourist arrivals increases by 0.32% with 1% increase in the number of threatened species. This finding suggests that, the more endangered species an attraction has, the more successful it will be as a

tourist destination. Protecting all species (endangered and not) in an ecosystem is vital for tourism success, and not putting more species at risk in order to make them rare to increase the number of tourist arrivals. It should be noted that many successful nature tourism destinations base their success on the protection of all species.

Moreover, income as represented by GDP per capita, better implementation of sound policies and regulations to enhance private sector development (governance), government investment in the travel and tourism sector (capital), and fixed broadband subscriptions (internet) are significant in increasing the number of international tourist arrivals in tourism destinations. However, insignificant exchange rate and life expectancy coefficients illustrate that tourists are insensitive to currency exchange as well as health and well-being in the destination country.

The reported outcome for the tourism demand model provides additional evidence on the importance of threatened species in supporting a growing tourism sector. It should be noted that tourism demand is associated with economic and non-economic factors. The government needs to implement policies and programs to increase tourist awareness to appreciate threatened species, as the revenues generated from the tourism sector could also be used for conservation purposes. The concept of last chance tourism should be implemented since these species would not be seen in the future. Therefore, recognizing the importance of threatened species as one of the elements in tourism demand is highly recommended as the tourism demand is also affected by the role of these species.

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### Data Availability Statement

All data that support the findings of this study are openly available and taken from IUCN Red List for the number of threatened species; World Development Indicators (WDI) for tourist, income, internet, and life expectancy; UNCTADSTAT for exchange rate; World Travel & Tourism Council (WTTC) for government spending on travel and tourism services, and Worldwide Governance Indicators (WGI) for governance index at:

(1)<https://www.iucnredlist.org/>

(2)<https://databank.worldbank.org/source/world-development-indicators>

(3)<https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=117>

(4)<https://wttc.org/Research/Economic-Impact/Data-Visualisation>

(5)<https://datacatalog.worldbank.org/dataset/worldwide-governance-indicators>

