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Effect of air quality in the place of origin on outbound tourism demand: Disposable income as a moderator

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HIGHLIGHTS

- A unique dataset comprising OTA outbound orders is built.
- The push effect of air quality on outbound tourism demand is confirmed.
- The moderate effect of disposable income is explored.
- The push effect of air quality will be delayed up to five days.
- The study results benefit operation management of OTAs.

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ABSTRACT

Tourism is largely dependent on climate and weather, and thus climatic attributes are expected to alter decisions of tourists. Utilising transaction data from a leading online travel agent (OTA) in China, this study explores the impacts of air quality, a critical environmental indicator, on outbound tourism demand whilst considering the moderating effects of disposable income at the city level. Empirical results show that air quality in the place of origin creates a pushing effect as local outbound tourism demand increases as air quality deteriorates. This relationship is negatively moderated by local disposable income level. This study also identifies a delay effect of five days in the impacts of air quality on outbound tourism demand. The theoretical contributions and implications of these findings for the operation management of OTAs and tourism destinations are presented at the end of this study.

1. Introduction

Tourism is a climate-dependent industry, and climatic variations can either facilitate or inhibit tourist participation in various destinations (Becken & Wilson, 2013). According to de Freitas (2003), climate has three facets, namely, aesthetic, physical and thermal aspects which are interdependent on each other. Aesthetic aspects, which greatly determine the attractiveness of a place as a tourism destination, are mainly affected by physical elements, such as sunlight, cloudiness and air quality of the location (Goh, 2012). Tourism researchers investigated impacts of climate on the tourism industry, ranging from geographical space and supply to demand and market agent of the tourism system (Martín, 2005). The rationale behind is that climate and weather conditions are major criteria to assess the suitability of tourism activities and ultimately determine destination choices (Amelung, Nicholls, & Viner, 2007; Becken, 2013; Goh, 2012; Rosselló–Nadal, 2014).

Changes in climate and weather conditions can also lead to tourism demand variations. For example, Goh (2012) moved beyond the conventional tourism demand framework by including non-economic factors (i.e. the socio-psychological variable of climate). Her findings confirm the proposed significance of climate in affecting tourism demand to Hong Kong from four source markets (i.e. the US, the UK, Japan and mainland China). Climate and weather conditions can also influence outbound tourism demand. Using transfer function models, Rosselló-Nadal, Riera-Font, and Cárdenas (2011) found that the dynamics of outbound British flows are contingent on a series of climatic variables, such as temperature, heat, air frost, sunshine days and short-term weather

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conditions. In accordance with the simple and useful pull–push framework, which explains driving forces underlying tourist mobility, climatic variables represent both a push and a pull factor in shaping the patterns of tourism demand.

A noteworthy feature of relevant literature is that research on the pulling aspects of climatic variables in tourism destinations discusses mainly the relationship between tourism demand and climatic conditions. The pushing effects of climatic variables are underlying the pulling effects. According to Dann (1977), 'push factors precede pull factors' (p. 207). Analytically, decisions on where to go and what to see come down to one essential choice: whether to go. In addition, the pulling effects of climatic attributes involved in selecting among alternative tourism destinations correspond closely to ambient environment in their place of residence (i.e., perceived differences of climate in the origin–destination pairs). McKercher, Shoval, Park, and Kahani (2015) suggested that the notions of tourists about weather are largely contingent on their perceived discrepancy between the weather in the destination (a novel place) and the familiar weather in the place of origin.

Most studies investigating the pushing effects of climate conditions on outbound tourism demand only consider the meteorological variables of rainfall, sunshine and temperature (Agnew & Palutikof, 2006; Rosselló-Nadal et al., 2011; Alvarez-Díaz & Rosselló-Nadal, 2010). Few academic efforts have been devoted to the impacts of air quality on outbound tourism demand. Like other climatic variables, air quality pertains to the physical comfort which is crucial to tourist experiences. In recent years, air quality has become a severe concern for human health. Evidence produced in medicine suggests that short-term and long-term exposures to ambient air pollution can engender a wide variety of acute and chronic health problems (Seaton, Godden, MacNee, & Donaldson, 1995).

Therefore, seeking for fresh air can become a critical motivational stimulator for spatial mobility at the international level that may ultimately affect international tourism flows and outbound tourism demand. Behavioural finance researchers found that environmental stimuli such as air quality can trigger mood swings which can bias the decision-making process at the time of making a choice (Kourtidis, Šević, & Chatzoglou, 2016; Li & Peng, 2016). In line with this finding, air quality is expected to strongly influence outbound tourist flows. However, verification of this effect is scarce in existing research.

This study aims to fill this research void and strengthen the theoretical and empirical foundation of the tourism demand literature. Firstly, this study focuses on the climatic element in places of origin instead of that in tourism destinations. Climatic attributes discussed in extant literature include sunny weather, cosy temperature, quality beaches and water-based activities which pull tourists away from their home places (Day, Chin, Sydnor, & Cherkauer, 2013). However, underlying these pull factors is a push concept that defines destination as a place of escape for self-recovery and recreation that gives tourists a sense of intimacy (Prayag & Ryan, 2011; Trauer & Ryan, 2005). Analysing climate elements in tourists' home countries as a push factor offers a new angle to understand tourism demand.

Secondly, this study avoids providing a general overview of the concept of climate. Rather, this study focuses on the specific climatic variable of air quality. McKercher et al. (2015) found that air quality is the most significant factor, and based on this finding, they highlighted air quality as an influential behavioural indicator for future research. Although many studies consider air quality a core external cost in the tourism industry (e.g. Saenz-de-Miera & Rosselló, 2014), few studies examine the effects of air quality on tourism demand. Evidence from air quality is normally associated with health costs, such as the acute and chronic effects of particulate matter (PM, PM10 and PM2.5) on human health (Chen, Ebenstein, Greenstone, & Li, 2013; Kampa & Castanas, 2008). Residents more likely exhibit denial and adopt exaggerated perceptions than new tourists because air quality is closely interrelated with home, work and social interaction settings (Evans, Jacobs, & Frager, 1982).

Thirdly, apart from precisely identifying the influence of air quality on tourism demand, this study considers the moderating effect of disposable income. Tourism scholars generally incorporated disposable income into the orthodox tourism demand framework and their empirical analyses depict disposal income as a crucial determinant for demand (e.g. Cai, Hu, & Feng, 2002; Wang, 2010; Yang, Liu, & Qi, 2014). In previous studies, a straightforwardly linear relationship between disposable income and tourism demand exists. That is, high-level income denotes high automobility. People with higher income than others are more capable of removing constraints to participating in tourism activities. Facing the ambient environment of worsening air quality, can disposable income still drive people overseas to escape the severe smog back home? The existing literature has not resolved this question.

This study seeks to address this research gap by evaluating the impact of a specific climatic variable (i.e. air quality) on outbound tourism demand whilst considering the moderating role of personal disposable income in such a relationship. Data for this study were gathered from a dominant online travel agent (OTA) in China. Given the difficulty of obtaining information related to the travel demand of individual tourists, this study follows previous studies, such as Granados, Gupta, and Kauffman (2012) and Li, Granados, and Netessine (2014) by using the number of orders tourists placed on this OTA within a single day as a proxy for tourism demand.

2. Literature review

2.1. Climate and tourism

Extensive studies on the travel motivations of tourists reveal multiple factors, including climate, discretionary time, travel costs and scenery (Jang & Wu, 2006), that are all connected to climate and weather to an extent (Gössling, Scott, Hall, Ceron, & Dubois, 2012). Smith (1993) identified two types of tourists, namely, climate-dependent and weather-sensitive tourists. The former refers to tourists who are attracted by favourable weather conditions in tourism destinations, whereas the latter refers to those who emphasise the critical role of weather in their decision-making process. These two categories correspond to pull-push factors relating to distinct decisions which are made at two separate timepoints. The pull-push provides a basic frame to analyse the impacts of climatic variables on the tourism industry.

Becken and Wilson (2013) found that half of their surveyed tourists changed their trip plans due to climatic conditions, whereas Martín (2005) found that temperate climatic variations merely drive tourists to switch from outdoor to indoor activities. Destination choice and tourism demand are also contingent on the climate in tourists' place of origin. Asymmetries exist in climate preferences across different source markets as the discrepancy between the climate in home places of tourists and that in their selected tourist destination frames their perceptions of climate (Bigano, Hamilton, & Tol, 2006). Scott, Gossling and de Freitas (2008) suggested that the preferred temperature of Swedish respondents is higher by almost 4 °C and 2 °C than that of their New Zealand and Canadian counterparts, respectively. Climate as a pulling force leads to a cross-regional substituting effect in destination selection. Pulling effect concerns where to go and what to do

which come after the issue of whether to go, a decision which closely relates to the push effect of climate.

Climatic variables can also be push factors on tourism demand. Eugenio-Martin and Campos-Soria (2010) examined the relationship between climate in the residence regions and choice between travelling domestically and abroad. The results of these studies demonstrate that residents from regions with good climate indices tend to travel domestically and less likely to travel overseas. Saverimuttu and Varua (2014) found that climate variability in the US is an important push factor to motivate American tourists travelling to the Philippines as the US tourist arrivals in the Philippines increase significantly when the US experiences La Niña-like weather conditions (i.e. cold season).

Ridderstaat, Oduber, Croes, Nijkamp, and Martens (2014) empirically identified rainfall, windspeed and temperature as significant push factors of seasonal US tourism demand for Aruba, whereas rainfall is a push factor for tourism demand for Venezuela. These studies assessing pushing effects of climatic elements on tourism demand mainly focus on calculations of thermal comfort for both domestic and international tourism demand. Ambient air quality should attract more academic attention than thermal comfort and aesthetic dimension of physical environment as the former is closely related to health risks. However, the existing literature places a relatively low attention on the effects of air quality on outbound tourism demand.

2.2. Air pollution as a health hazard and tourism factor

In addition to the hedonic dimension that is widely investigated in previous studies, climatic variables can cause concerns for human health. Air pollution has become a critical environmental issue nowadays. For example, smog, a relatively constant and calculable form of hazard, is becoming increasingly frequent and may cause severe consequences on the environment and public health (Adgate, Goldstein, & McKenzie, 2014). The London Smog of 1952 reveals that dense particulate-based smog dramatically increases daily mortality (Schwartz, 1994).

Intuitively, a contaminated environment, such as that with polluted water and air, inhibits the development of the tourism industry in a certain place. For example, the nuclear accident in Fukushima, Japan in 2011 greatly affected the inbound tourism of the whole country (Nikkei Asian Review, 2017). As risk avoidance is inherent in the motivations of tourists and the global climate change is continuing, it is reasonable to argue that air quality is an expeller pushing tourists away from their resident places.

Urban air pollution is a complex mixture of hazardous elements, among which particulate matter is a major air pollutant for public health. Its seasonal variation is complicated and location-dependent, making it an air quality problem year-round (Jacob & Winner, 2009). Epidemiological studies constantly suggest that particulate air pollution not only exacerbates illness in people with respiratory disease but also increases mortality from cardiovascular and respiratory disease among elders (Seaton, MacNee, Donaldson, & Godden, 1995). However, public awareness of poor air quality is far from universal as perceived environmental risk of air pollution is inextricably tied to socially localised context (Bickerstaff & Walker, 2001). Direct experience is more crucial in developing perceptions of air quality than secondary information and media coverage.

Tourism scholars also shared similar observations. For example, Evans et al. (1982) found that residents are more likely to exhibit denial and adopt exaggerated perceptions than new tourists because air quality is closely interrelated with home, work and social interaction settings. Scholars generally agreed that fresh air is fundamental to the competitiveness of a tourism destination (e.g. Gao & Kerstetter, 2016; Li, 2004). This consensus signifies that the relatively high-level air quality in the intent destination as demand for climate-related elements mainly stems from discrepancy between tourism destinations and places of origin (Bigano et al., 2006). Therefore, considering the year-round dynamic changes, air quality can be regarded as a critical pushing escape stimulator.

2.3. Outbound tourism in China

Outbound tourism has become an important sector that expands rapidly along with the high-income growth rates in developed and newly industrialised countries as well as the substantially decreasing international transportation costs (Lim, 1997). The rapid growth of China's tourism market has attracted much attention in recent years. Within two decades, the number of outbound tourists in the country increased from 2,988,700 to 70,250,000, making China an important export market for many eastern and western countries from an international perspective (Dai, Jiang, Yang, & Ma, 2017).

Such a momentum is facilitated by a series of macroeconomic factors economically and politically, such as the increase of GDP and the removal of institutional and economic policy restrictions (Keating & Kriz, 2008). Outbound tourism in China is managed and regulated by the Approved Destination Status (ADS) scheme, under which 140 countries were approved as ADS countries by the end of 2011 (People's Daily, 2011). During the transition from central-planned economy to a market-driven economy, outbound Chinese tourists are mainly geared towards shopping which is partially based on the conclusion of Dai et al. (2017) that outbound tourism in China is still in the preliminary developmental stage.

Dai et al. (2017) also observed that the Chinese outbound market is maturing as more focus is given to enjoying a pleasant travel experience than to other factors. Fresh air is a critical factor in creating a pleasant journey as it not only relates to local physical atmosphere but also a health issue. Seeking for fresh air has become a strong pushing factor for Chinese outbound tourists. In December 2016, Ctrip, the largest OTA in China, released a haze travel report which recorded up to 150,000 Chinese travelling overseas specifically for fresh air (Forbes, 2017). According to this report, a clear correlation between severity of air pollution and number of population urging to escape exists as cities in this dirty market segment were among the top 10 haze evading cities, such as Beijing and Shanghai.

Air pollution continues to be a fact of life in most cities (Forbes, 2016), despite the achievements of the Chinese government in maintaining a healthy and sustainable environment. More importantly, anticipated improvements in air quality may be modulated by climate change variations, such as global warming. Principal components of particulate matter such as sulfate, nitrate and carbon particles particularly depend on temperature and greenhouse gas emissions (Jacob & Winner, 2009). Therefore, seeking for fresh air can be a strong pushing motivator for the Chinese outbound tourism market in the future.

3. Hypothesis development

3.1. Effect of air quality on outbound tourism demand

Previous studies mainly conceptualise weather and climate as pull factors and focus on the stimulating roles of climatic variables in destination selection. Scholars also discussed the pushing effects of climate variables (e.g. sunshine, temperature, rainfall precipitations) in generating outward tourism flows (Agnew & Palutikof, 2006). In addition, previous studies reveal that the meteorological variables in places of origin are significant

indicators of outbound tourism demand and their incorporation in demand models can increase their predictive power (Rosselló-Nadal et al., 2011). However, literature on the impacts of air quality, a climatic variable which is gaining growing concerns in contemporary society, on outbound tourism demand is scant. The current study is a natural extension of extant literature regarding the relationship between outbound tourism and climate in tourists' place of origin.

Worsening ambient air quality is significantly associated with depressed moods, such as annoyance, depression and tension (Li & Peng, 2016; Stenlund, Lidén, Andersson, Garvill, & Nordin, 2009). Given its close connections to mood, behavioural financial researchers often used air quality as a proxy for people's mood (Levy & Yagil, 2011). In the tourism context, scholars generally agreed that tourists' mood intensity is imperative in the product and service evaluation which determines tourist experience and satisfaction to a great extent (Huang, Scott, Ding, & Cheng, 2012). Therefore, arguing that air quality influences the decision-making process of tourists is reasonable.

Based on affirmative evidence from the field of medicine, day-to-day particulate air pollution is a significant environmental risk factor of various health problems, such as lung cancer (Pope III et al., 2002). Such adverse health outcomes are more sensitively perceived by locals than by new tourists (Evans et al., 1982), which means the perceived utility of staying in a city becomes low. According to the utility theory, consumers will choose the highest perceived utility option. Residents can opt to stay or escape. The perceived utility of escaping (outbound trip) which comprises the cost of money and time and the gain of enjoying high air quality is fixed or even increasing, whereas the perceived utility of staying is decreasing. Eventually, when the perceived utility of escaping is high, individuals are likely take an outbound trip.

Amelung et al. (2007) claimed that pushing factors are 'origin related and refer to factors such as travellers' desires and the negative or undesirable aspects of the climate in their home region' (p. 286). Giles and Perry (1998) treated the abnormal weather in 1995 as a temporal analogue to examine the impacts of projected global warming on the UK tourism industry. Their research identifies a strong relationship between weather and intentions to travel abroad. Poor air quality (air pollution) can be regarded as a kind of abnormal weather. Therefore, air quality is likely to exert pushing effects on outbound tourism demand.

In practice, the time and location of the haze travel in eastern China provided evidence that air quality may exert a causal pushing effect on the outbound tourism market. At the end of 2016, a haze travel report issued by Ctrip indicated that the number of overseas tourists would exceed 150,000 in December 2016 when the red smog alert was on in many Chinese cities (Forbes, 2017). Based on findings from the extant literature and practical observations, we hypothesise the following:

H1. *The severity of air quality (i.e. low air quality represented by high air quality index) in the place of origin negatively influences outbound tourism demand.*

3.2. Moderating effect of disposable personal income (DPI)

Tourism is regarded as symbolic consumption and is often accorded a degree of social status (Dimanche & Samdahl, 1994). Conspicuous consumption can deliberately and visually serve as a signal of the social position and status of individuals (Campbell, 1995). International tourism clearly fits the conspicuous consumption profile, under which touristic gaze is a conspicuous manifestation of agent–target power relations (Cheong & Miller, 2000). Outbound tourists are visibly distinguished from locals in terms of their language and dressing styles, thereby making them objects of the gaze (Trauer & Ryan, 2005).

International tourism offers people an arena to distinguish themselves from their significant others, such as friends, relatives and neighbours. In examining the Japanese language, Moeran (1983) found that the characteristics of outbound travel, such as choice of destination and length of stay, are greatly contingent on the social status of tourists. Tourism activities cannot easily become invisible to others because such activities can be manifested in many ways, such as photos, souvenirs and verbal descriptions. If tourists want to symbolise their social status, then purchasing positioned goods of luxury products and consuming fancy local food (Kim, Eves, & Scarles, 2009; Park, Reisinger, & Noh, 2010) can be an option.

The conspicuous nature of tourism is largely due to the nature of tourism experiences. The materialization of the consumption of tourist objects is associated with high-level disposable income and extended leisure time (Todd, 2001). Disposable income is a relative concept compared to the absolute term of personal income. Given the inherent nature of tourism as a conspicuous consumption, disposable income must be adopted in discussing tourism demand due to the intrinsically comparative feature of tourism activities. In addition to the conspicuous nature of tourism, its mobility-related costs, such as those related to transportation and accommodation, highlight the importance of economic factors in removing the obstacles to participating in tourism activities. Taking the high fiscal and time costs involved in international tourism into account, international tourists are considered rich in money and time.

The influence of social status on conspicuous tourism consumption can be more significant in China than in other countries. Mok and DeFranco (2000) posited that the Chinese culture values the symbolic significance of goods and products which are closely embedded in people's daily lives. Faced with a deteriorating air quality, people with high disposable income can invest in air purifiers and healthcare to scale down air-related health hazards. These people also consider travel as a means to maintain their social status because both travel and shopping are social status symbols (Kim et al., 2009; Park et al., 2010). At the regional level, signalling wealth status has a determining role in international tourism demand for areas with high average income. Therefore, the impacts of air quality on outbound tourism demand can be moderated by disposable income. The travel decisions of people with high disposable income are less likely influenced by extrinsic factors, such as air quality, than that of people with low disposable income. Thus, this study proposes the following:

H2. *The local disposable income level negatively moderates the relationship between air quality and outbound tourism demand, that is, the influential power of air quality lessens when the local disposable income level is high.*

4. Data and variables

Data used in this study were obtained from multiple sources. Firstly, similar to the approaches of Granados et al. (2012) and Li et al. (2014), the number of tourists in a city who placed their orders within a day was used as a proxy for tourism demand because obtaining actual figures for the actual outbound tourism demand of individuals is difficult. Data for outbound travel were obtained from a leading OTA company in China which ranked as one of the top five OTAs (TravelDaily, 2017). The overseas travel package orders for 2016 in a province in eastern China were used for subsequent analysis. A total of 36,314 orders were recorded which tracked several attributes including placement date, placement city, price and number of tourists. A city-day level panel dataset (with 11

cities × 366 daily observations) was constructed based on data characteristics. Secondly, the daily air quality index (AQI) data for each city in 2016 were retrieved from www.aqistudy.cn, a non-profit platform that records the climatic information of up to 367 cities in China on an hourly basis. Given the widely recognised lagging effect in the behavioural responses of consumers to weather, this study recorded the AQI for seven consecutive days (we also tried 3 and 14 days in robustness check), and the average AQI was used for the analysis. Thirdly, the local disposable income level, which is measured by the capita disposable income (*DPI*) of each city in 2015, was collected from the provincial Bureau of Statistics. Descriptions of these three variables are presented in Table 1, their descriptive statistics in Table 2 and their correlation matrix in Table 3.

Table 2
Descriptive statistics of the variables of interest.

Variable	# of Obs.	Mean	S. D.	Min.	Max.
Tourists	4026	35.370	89.8156	0	1334
AQI7	4026	73.370	21.8348	24.286	171.143
DPI	4026	35,600.64	5554.448	25,080.66	42,734.54

Table 3
Correlation coefficient matrix of the variables of interest.

	Tourists	AQI7	ln(DPI)
Tourists	1		
AQI7	0.083	1	
ln(DPI)	0.319	0.207	1

5. Results of the empirical analysis

5.1. Empirical econometric model

This study used a linear regression model with panel data as the base model to identify the effect of air quality on outbound tourism demand. The analysis unit is city-day, i.e., the observation for each city in each day. An important issue in panel data analysis is the choice between the fixed effects model and the random effects model. Tourist behaviour is greatly shaped by social norms and values which are closely contingent on geographical locations (Pizam & Milman, 1986). In this case, outbound travel behaviour may differ across cities, and a city-specific heterogeneity is observed. Therefore, using the fixed effects model is more appropriate to account for such city-specific heterogeneity than adopting the random effects model. The Hausman test also suggests the superiority of the fixed effects model as the test statistics reject the random effects model (17.63 with p-value < 0.001). Therefore, the fixed effects model is used as the base model which is expressed as follows:

$$Tourists_{i,t} = \beta_0 + \beta_1 AQI7_{i,t} + \alpha_i + \mu_{i,t} \quad (1)$$

where α_i is the unobservable time invariant individual effect, and $\mu_{i,t}$ represents the idiosyncratic error that varies over time and across individuals.

An interaction term between *AQI7* and *DPI* must be included to further investigate the moderation effect of local disposable income level on the relationship between air quality and outbound tourism demand. Given that the scale of *DPI* is larger than *AQI7* and *Tourists*, a natural logarithm transformation was performed for *DPI*: $ln(DPI_i) = ln(DPI_i + 1)$. The interaction term between *AQI7* and *DPI*, which is denoted by $AQI7_{i,t}{*}ln(DPI_i)$, was then included in the base model expressed as follows:

$$Tourists_{i,t} = \beta_0 + \beta_1 AQI7_{i,t} + \beta_2 AQI7_{i,t}{*}ln(DPI_i) + \alpha_i + \mu_{i,t} \quad (2)$$

Given that the dependent variable *Tourists* measures the sales performance of outbound travel products, this variable is expected to vary across time. Such a variation is well recognised as a seasonality pattern in the tourism demand literature (Goh & Law, 2002; Hwang, Lin, & Matzarakis, 2011; Lim & McAleer, 2001). For example, public holidays can help remove the time constraints imposed on the travel motivations of people. Therefore, orders that are placed one or two months prior to holidays are overwhelmingly higher than those placed in other periods. In contrast with climate-induced seasonality, institutional factors can produce seasonal patterns or institutional seasonality (Amelung et al., 2007; Scott, Jones, & Konopek, 2007). To control for these time fixed effects, two sets of dummy variables were included in the model as shown in Equation (3). One of these variables denotes the month of day t (the matrix $\boldsymbol{M}$ in Equation (3)) to control for the monthly fixed effects, whereas the other variable denotes the day of the week of day t (the matrix $\boldsymbol{D}$) to control the day of the weekly fixed effects.

$$Tourists_{i,t} = \beta_0 + \beta_1 AQI7_{i,t} + \beta_2 AQI7_{i,t}{*}ln(DPI_i) + \boldsymbol{\gamma_1 M}_{i,t} + \boldsymbol{\gamma_2 D}_{i,t} + \alpha_i + \mu_{i,t} \quad (3)$$

Serial correlation is a common estimation issue in time series data analysis. The Wooldridge test was performed to measure the first order autocorrelation (Wooldridge, 2006), and the result indicates a serial correlation ($F(1, 10) = 20.784$ with p-value < 0.001). An AR (1) process was included in the empirical econometric model to address this issue.

5.2. Results

This study applied OLS, which is considered unbiased for the fixed effect linear regression model with AR (1) process, to estimate the proposed models. The results of the full empirical model (Equation (3)) are presented in Table 4. Dummy variable coefficients for time fixed effects were not reported in this paper because of space limitations.

Table 4 shows a positive connection between *AQI7* (i.e. average AQI in the last seven days) and the number of outbound tourists. Given that a high AQI indicates a low air quality and that the outbound tourism demand is measured by the number of outbound tourists in OTA, H1 is supported. In addition, the coefficient value of 13.09 means that a one-unit increment of *AQI7* leads to more than 13 people travelling abroad. Given that AQI considerably varies over time (the standard deviation of *AQI7* is 21.83) and that the mean of *Tourists* is only 35.37, this variable exhibits great influential power.

Table 1
Description of the variables of interest.

Name of variables	Description
$Tourists_{i,t}$	The number of people who placed outbound trip orders in the OTA in city i on day t.
$AQI7_{i,t}$	Average air quality index of city i seven days before day t (i.e., from day t-1 to day t-7).
DPI_i	Capita disposable income of city i in the previous year (i.e., 2015).

Table 4
Main results of the regression model.

Tourists	Coef. (Std. Error)
AQI7	13.09(5.226) **
*AQI7*ln(DPI)*	−1.270(0.498) **
Month fixed effects	Yes
Day fixed effects	Yes
City fixed effects	Yes
Constant	31.22(6.338) ***
# of obs.	4015
AIC	44,649.7
BIC	44,775.6
F	13.35

***p < 0.01, **p < 0.05, *p < 0.1, standard errors are reported in parentheses.

Table 4 also reports the results regarding the moderating effect of disposable income. The negative sign of the interaction term *AQI7*ln (DPI)* reveals that local disposable income level negatively moderates the impacts of *AQI* on outbound tourism demand. That is, the influential power of *AQI7* on the number of outbound tourists decreases as the local disposable income level increases. Consequently, H2 is empirically supported.

Apart from examining the relationship between tourism demand in day t and air quality from day t-1 to day t-7, this study further investigates the delay effect that depicts how long the impact of air quality lasts. This study replaced the dependent variable of $Tourists_{i,t}$ with $Tourists_{i,t+k}$, where $k = 1, 2, 3, 4, 5, 6$ to address the delay effect. Table 5 presents the results of delay effect. The direct influences of *AQI7* as well as the interaction terms are positively significant across the first five models, indicating that the influence of air quality can be delayed by up to five days. Furthermore, the influence power of *AQI7* reaches its peak on day t+1 and then decreases with time. Fig. 1 shows this trend by plotting the coefficients of *AQI7* and AQI7**ln (DPI)* in all seven models (i.e. the full model and the six delay effect models) with a 90% confidence interval.

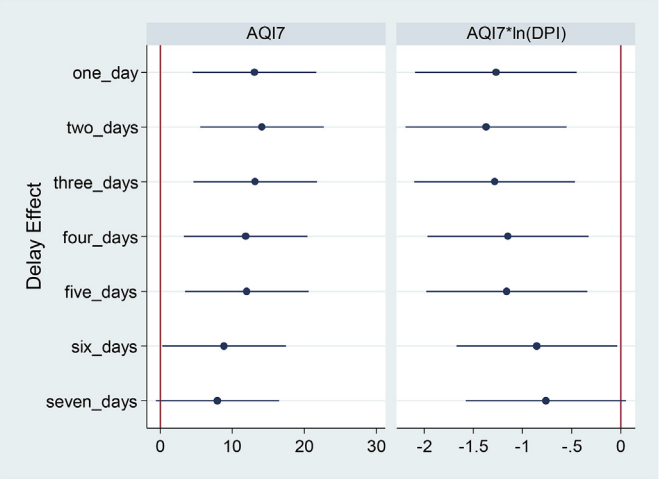

Fig. 1. Trends of air quality's effect and DPI's moderation effect.

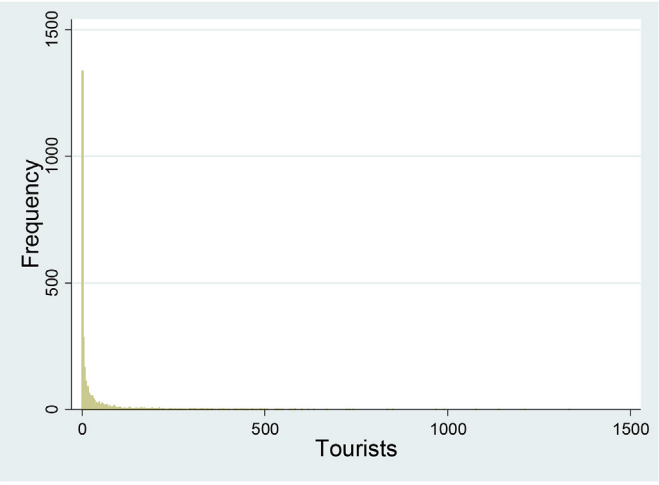

Fig. 2. Distribution of *Tourists*.

5.3. Robustness check

Several robustness checks were performed to examine the robustness of results. The model specifications were changed in the first check. Given that the distribution of *Tourists* looks similar to a censored normal distribution (Fig. 2), a Tobit regression model (Equation (4)) can be applied, where y^* is a latent variable.

$$\begin{cases} Tourists_{i,t} = 0 & if\ y^* \le 0 \\ Tourists_{i,t} = y^* & if\ y^* > 0 \end{cases},$$

Table 5
Results of the delay effect of AQI.

Tourists	+1 day	+2 days	+3 days	+4 days	+5 days	+6 days
AQI7	14.12***	13.21**	11.86**	12.01**	8.895*	7.942
	(5.213)	(5.212)	(5.219)	(5.218)	(5.209)	(5.197)
*AQI7*ln(DPI)*	−1.371***	−1.283***	−1.149**	−1.161**	−0.855*	−0.762
	(0.497)	(0.497)	(0.498)	(0.497)	(0.497)	(0.495)
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Day of the week fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	54.18***	55.28***	49.14***	39.20***	33.31***	11.25*
	(6.287)	(6.291)	(6.293)	(6.298)	(6.285)	(6.275)
# of obs.	4015	4015	4015	4015	4015	4015
AIC	44,650.2	44,650.5	44,651.4	44,655.1	44,654.9	44,656.2
BIC	44,776.2	44,776.5	44,777.3	44,781.1	44,780.9	44,782.2
F	13.34	13.32	13.24	13.04	13.03	12.95

***p < 0.01, **p < 0.05, *p < 0.1, standard errors are reported in parentheses.

where $y^* = \beta_0 + \beta_1 AQI7_{i,t} + \beta_2 AQI7_{i,t} * ln(DPI_i) + \gamma_1 \boldsymbol{M_{i,t}} + \gamma_2 \boldsymbol{D_{i,t}} + \alpha_i + \mu_{i,t}$ (4)

This study added a one-period lagged dependent variable because including the AR (1) process in a nonlinear model like the Tobit model is difficult. The results in Table 6 clearly show that both hypotheses are supported because *AQI7* is significantly positive and *AQI7*ln (DPI)* is significantly negative. Although coefficient values differ, the Tobit model results are largely consistent with the main results.

In addition to changing the model specifications, the time window of the average AQI calculation was changed. The *AQI7* in our main full model (Equation (3)) was replaced by average AQI in the recent 3 and 14 days before running the regression model again. The results of the models with an alternative time window are presented in Table 7 and are consistent with the main results presented in Table 4.

We replaced the dependent variable $Tourists_{i,t}$ with $Orders_{i,t}$ which denotes the number of outbound travel orders placed in city *i* in day *t*. We ran the full model and all six delay effects models. The hypotheses are supported by the results of the one-day delay model and the two-days delay model, as shown in Table 8. Such results are expected because the analyses were performed at the order level. The relationship between the number of tourists and orders is complex. One order can contain any number of tourists as wanted by a customer (i.e. one order in our data contains 158 tourists) as long as the OTA permits. In addition, such a relationship is unlikely to be linear. Therefore, the number of orders can only roughly reflect the outbound tourism demand. As a result, the insignificant relationship between AQI and the number of orders is expected. However, the results of the one-day delay model and the two-day delay model offer additional evidence to support the robustness of our main results.

6. Discussion and conclusions

Tourism is dependent on natural resources and air quality is a climatic element imperative for the tourism industry. Well acknowledging the pervasiveness of this element, a few researchers examined connections between air quality and the tourism industry from two broad perspectives, that of air quality determining destination competitiveness (e.g. Mihalič, 2000) and that of tourism growth changing air quality (e.g. Koenen, Chor, & Christianson, 1995). These studies examine air quality in the context of tourism destination and focus on the pulling effects of air quality while overlooking its equally, if not more, indispensable effect as a pushing stimulator. To fill this research void, the current study focuses on the impacts of air quality in tourists' places of origin on outbound tourism demand while considering the moderating effect of disposable income.

Table 6
The results of the Tobit model.

Tourists	Coef. (Std. error)
AQI7	8.830(3.327) ***
*AQI7*ln(DPI)*	−0.857(0.317) ***
Tourists lag(1)	0.388(0.0145) ***
Month fixed effects	Yes
Day of the week fixed effects	Yes
City fixed effects	Yes
Constant	135.1(9.991) ***
# of obs.	4015
AIC	44,671.9
BIC	44,873.5

***p < 0.01, **p < 0.05, *p < 0.1, standard errors are reported in parentheses.

Table 7
Result of models with an alternative time window.

Tourists	AQI in 3 days	AQI in 14 days
AQI	7.760(3.977) *	14.01(6.624) **
*AQI*ln(DPI)*	−0.751(0.379) **	−1.355(0.631) **
Month fixed effects	Yes	Yes
Day of the week fixed effects	Yes	Yes
City fixed effects	Yes	Yes
Constant	21.19(5.157) ***	28.88(8.231) ***
# of obs.	4015	4015
AIC	44,655.2	44,655.0
BIC	44,781.1	44,780.9
F	13.01	13.04

***p < 0.01, **p < 0.05, *p < 0.1, standard errors are reported in parentheses.

Firstly, this study empirically verified the proposed pushing effect of air quality on outbound tourism demand in the context of China. In the tourism context, air quality is regarded as an important factor to thermal, physical, and aesthetic conditions at destinations (de Freitas, 2003). The current study reveals that the pushing effect of poor air quality is equally important in stimulating people to travel outbound. Unlike overwhelming natural hazards such as earthquakes and tsunami, poor air quality causes chronic and continuous health problems shift tourist flows to places with better air quality. The smoke haze in China is a predictable recurrence that normally reaches its peak during late winter and early spring, especially in December and January. Therefore, in addition to the widely identified climatic factors (e.g. temperature and sunlight), air quality is an equally important climatic factor causing seasonality in tourism. This finding may rewrite the landscape of international tourism considering the momentums of outbound tourism development in China. China started 2017 with the first ever nationwide red level fog alarm. Search engines in China also noted record numbers for the search terms 'where to go', 'wash the lungs', and 'forests' (Forbes, 2017).

Secondly, this study contributes to the literature by suggesting a distinctive form of mobility, the haze-induced seasonal migration, consisting of haze-avoidance tourists. This type of tourists differs from escape travellers who are trying to be free from their routines, and tourism offers these travellers a transformative experience (Pritchard, Morgan, & Ateljevic, 2011). Haze travellers are unlike the fresh air seekers who are motivated by physical comfort (Wang, 2017). Patterns of haze travellers are relatively persistent and somewhat predictable, at least in terms of occurrence time and destination features.

Thirdly, this study reveals that disposable income can moderate the influences of air quality on outbound tourism demand. Scholars widely acknowledged that the level of disposable income determines tourism demand (e.g. Papatheodorou, 2001). Similarly, our study shows that disposable income exerts an indirect effect on tourism demand. The influence of air quality on the tourism demand of people with high disposable income will be lower than that of people with low disposable income. Therefore, when using air quality as an indicator of outbound tourism demand, the level of disposable income in a certain place should be considered. In this case, OTAs must pay more attention to less developed areas (lower DPI) than developed ones (higher DPI) because the outbound tourism demand of their residents tends to be influenced by air quality.

Fourthly, this study discovers a time delay in the effect of air quality on outbound tourism demand. Falk (2014) reported that the lagging effect of weather on foreign (outbound) tourism demand can extend up to one year. Agnew and Palutikof (2006) presented similar observations that outbound tourism flows are significantly

Table 8
The effect of AQI on the number of placed orders.

Orders		Delay effect					
		1 day	2 days	3 days	4 days	5 days	6 days
AQI7	1.012	1.999*	1.970*	1.651	1.661	0.529	0.0408
	(1.023)	(1.021)	(1.021)	(1.025)	(1.028)	(1.028)	(1.026)
*AQI7*ln(DPI)*	−0.0982	−0.194**	−0.192**	−0.161	−0.160	−0.0503	−0.00315
	(0.0976)	(0.0974)	(0.0974)	(0.0978)	(0.0980)	(0.0980)	(0.0978)
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day of the week fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	5.575***	12.26***	13.12***	11.59***	8.439***	7.380***	2.738***
	(0.896)	(0.879)	(0.879)	(0.878)	(0.881)	(0.879)	(0.879)
# of obs.	4015	4015	4015	4015	4015	4015	4015
AIC	29,587.1	29,579.8	29,585.3	29,581.4	29,599.8	29,592.8	29,599.2
BIC	29,713.0	29,705.7	29,711.2	29,707.4	29,725.8	29,718.7	29,725.1
F	18.56	18.95	18.64	18.77	17.73	18.09	17.72

***p < 0.01, **p < 0.05, *p < 0.1, standard errors are reported in parentheses.

affected by rain precipitation and sunshine days in the previous year. By contrast, the current study reveals that the influence of air quality on outbound tourism can lag behind for up to five days. Such a noteworthy discrepancy in the length of lagging effect can be credited to the adverse health outcomes of air pollution. The selected meteorological variables in studies such as Falk (2014) and Agnew and Palutikof (2006) are sunshine, temperature, and rainfall. The reaction time of people to factors which may harm their life can be much more spontaneous and instant compared with their reaction time to hedonic factors. Therefore, the current study strongly encourages tourism marketers to keep a close eye on AQI, particularly on air quality records for the past five days. As mentioned above, OTAs must pay more attention to the less developed areas (lower DPI) than developed areas (higher DPI) because the outbound tourism demand of the residents tends to be more influenced by air quality.

This study also yields managerial implications for travel agents and governments. Firstly, given that air quality can significantly influence the outbound tourism demand of people, travel agents should plan their ability to supply outbound tourism products in consonance with their local air quality. Although predicting short-term air quality is challenging, the seasonality of air quality enables long-term predictions. For example, in northern China, municipal heating by coal substantially contributes to air pollution, raising levels of air pollution many times above the standard permitted by World Health Organization and setting off a red or orange smog alert alarm. Air quality is correlated with monsoon and temperature. Mohan and Kandya (2007) supported such an observation as they recorded the worst air quality during winter and the best air quality during monsoon. Results in the current study are valuable to travel agents in designing outbound tourism products and marketing activities.

Secondly, the moderating effect of disposable income level suggests that travel agents must customise marketing strategies to accommodate divergent needs and wants from targeted customers. As air quality exerts a large marginal effect for individuals with low disposable income, marketing activities of travel agents should emphasise the negative effects of air pollution and the health-related benefits of travel products. On the contrary, tourism marketers need to offer customers of high disposable income products with alternative types of benefits, instead of investing in advertising air pollution and products about personal health because air quality exerts a low marginal effect on this population.

Thirdly, air quality can be an important selling point in designing an attractive tour route. For example, travel agents can design a 'fresh air enjoyment' tour route because air quality is an important driver of outbound tourism. Marketing organizations in destination countries targeting Chinese outbound travellers can develop some tourist attractions with fresh air to attract tourists from areas with low air quality.

Despite addressing an important issue in the tourism demand literature, this study has several limitations. Firstly, following previous academic attempts, this study used actual orders that are placed on a dominant OTA platform to measure tourism demand. While acknowledging the ubiquitous nature of the Internet and hence OTA platforms, there are many other sales channels utilized by people, such as the elders, for tourism products. Therefore, a possible gap exists between those orders that are placed on transaction platforms and the actual number of tourists who travel overseas in a given time because people can place their outbound orders in other OTA platforms or through offline travel agents. Our data do not allow the examination of the influence of air quality on actual tourism demand. Future study should collect more data from other OTAs and offline travel agents. Secondly, although the employed dataset in this study covered orders from 11 cities over a year, its representativeness was limited because only one eastern province in China was included. thanks to its broad land area, China generally has six temperature zones from south to north, including equatorial, tropical, sub-tropical, warm-temperate, temperate, and cold-temperate. The unbalanced economic development across the whole nation further complicates the measurement of air quality in China. Therefore, future studies can check for data at the national level. Thirdly, considering the ongoing climate change that can also change the situation of air quality, data of a single year is not enough to fully picture how air quality influences tourism demand. However, as the smoke haze in China is a predictable recurrence, our conclusion remains valuable. Becken (2013) found that impacts of climatic variables (i.e. sunshine, rain, and temperature) on annual variations of visitor nights are insignificant, suggesting that data within a given year are, to an extent, adequately representative and reflective. We still firmly believe that a larger data set is more effective in capturing the effects of air quality on tourism demand.

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References

Adgate, J. L., Goldstein, B. D., & McKenzie, L. M. (2014). Potential public health hazards, exposures and health effects from unconventional natural gas development. *Environmental Science and Technology, 48*(15), 8307–8320.

Agnew, M. D., & Palutikof, J. P. (2006). Impacts of short-term climate variability in the UK on demand for domestic and international tourism. *Climate Research, 31*(1), 109–120.

Alvarez-Díaz, M., & Rosselló-Nadal, J. (2010). Forecasting British tourist arrivals in the Balearic Islands using meteorological variables. *Tourism Economics, 16*(1), 153–168.

Amelung, B., Nicholls, S., & Viner, D. (2007). Implications of global climate change for tourism flows and seasonality. *Journal of Travel Research, 45*(3), 285–296.

Becken, S. (2013). Developing a framework for assessing resilience of tourism subsystems to climatic factors. *Annals of Tourism Research, 43*, 506–528.

Becken, S., & Wilson, J. (2013). The impacts of weather on tourist travel. *Tourism Geographies, 15*(4), 620–639.

Bickerstaff, K., & Walker, G. (2001). Public understandings of air pollution: The 'localisation'of environmental risk. *Global Environmental Change, 11*(2), 133–145.

Bigano, A., Hamilton, J. M., & Tol, R. S. J. (2006). The impact of climate on holiday destination choice. *Climatic Change, 76*, 389–406.

Cai, L. A., Hu, B., & Feng, R. (2002). Domestic tourism demand in China's urban centres: Empirical analyses and marketing implications. *Journal of Vacation Marketing, 8*(1), 64–74.

Campbell, C. (1995). Conspicuous confusion? A critique of Veblen's theory of conspicuous consumption. *Sociological Theory, 13*(1), 37–47.

Chen, Y., Ebenstein, A., Greenstone, M., & Li, H. (2013). Evidence on the impact of sustained exposure to air pollution on life expectancy from China's Huai River policy. *Proceedings of the National Academy of Sciences, 110*(32), 12936–12941.

Cheong, S. M., & Miller, M. L. (2000). Power and tourism: A foucauldian observation. *Annals of Tourism Research, 27*(2), 371–390.

Dai, B., Jiang, Y., Yang, L., & Ma, Y. (2017). China's outbound tourism-Stages, policies and choices. *Tourism Management, 58*, 253–258.

Dann, G. M. (1977). Anomie, ego-enhancement and tourism. *Annals of Tourism Research, 4*(4), 184–194.

Day, J., Chin, N., Sydnor, S., & Cherkauer, K. (2013). Weather, climate, and tourism performance: A quantitative analysis. *Tourism Management Perspectives, 5*, 51–56.

Dimanche, F., & Samdahl, D. (1994). Leisure as symbolic consumption: A conceptualization and prospectus for future research. *Leisure Sciences, 16*(2), 119–129.

Eugenio-Martin, J. L., & Campos-Soria, J. A. (2010). Climate in the region of origin and destination choice in outbound tourism demand. *Tourism Management, 31*(6), 744–753.

Evans, G. W., Jacobs, S. V., & Frager, N. B. (1982). Behavioral responses to air pollution. *Advances in Environmental Psychology, 4*, 237–269.

Falk, M. (2014). Impact of weather conditions on tourism demand in the peak summer season over the last 50 years. *Tourism Management Perspectives, 9*, 24–35.

Forbes. (2016). *Is China's pollution accelerating climate change?*. https://www.forbes.com/sites/sarahsu/2016/09/08/is-chinas-pollution-accelerating-climate-change/#5de00ef537ef . (Accessed 24 November 2017).

Forbes. (2017). *As smog hits China, Chinese tourists seek fresh air on pollution free holidays*. Retrieved on August 7, 2017 via https://www.forbes.com/sites/profdrwolfganggarlt/2017/01/05/chinese-online-travel-agency-publishes-haze-travel-list/#12ef932850dc.

de Freitas, C. R. (2003). Tourism climatology: Evaluating environmental information for decision making and business planning in the recreation and tourism sector. *International Journal of Biometeorology, 48*(1), 45–54.

Gao, J., & Kerstetter, D. L. (2016). Using an intersectionality perspective to uncover older Chinese female's perceived travel constraints and negotiation strategies. *Tourism Management, 57*, 128–138.

Giles, A. R., & Perry, A. H. (1998). The use of a temporal analogue to investigate the possible impact of projected global warming on the UK tourist industry. *Tourism Management, 19*(1), 75–80.

Goh, C. (2012). Exploring impact of climate on tourism demand. *Annals of Tourism Research, 39*(4), 1859–1883.

Goh, C., & Law, R. (2002). Modeling and forecasting tourism demand for arrivals with stochastic nonstationary seasonality and intervention. *Tourism Management, 23*(5), 499–510.

Gössling, S., Scott, D., Hall, C. M., Ceron, J. P., & Dubois, G. (2012). Consumer behaviour and demand response of tourists to climate change. *Annals of Tourism Research, 39*(1), 36–58.

Granados, N., Gupta, A., & Kauffman, R. J. (2012). Online and offline demand and price elasticities: Evidence from the air travel industry. *Information Systems Research, 23*(1), 164–181.

Huang, Y., Scott, N., Ding, P., & Cheng, D. (2012). Impression of Liusanjie: Effect of mood on experience and satisfaction. *International Journal of Tourism Research, 14*(1), 91–102.

Hwang, R. L., Lin, T. P., & Matzarakis, A. (2011). Seasonal effects of urban street shading on long-term outdoor thermal comfort. *Building and Environment, 46*(4), 863–870.

Jacob, D. J., & Winner, D. A. (2009). Effect of climate change on air quality. *Atmospheric Environment, 43*(1), 51–63.

Jang, S. S., & Wu, C. M. E. (2006). Seniors' travel motivation and the influential factors: An examination of Taiwanese seniors. *Tourism Management, 27*(2), 306–316.

Kampa, M., & Castanas, E. (2008). Human health effects of air pollution. *Environmental Pollution, 151*(2), 362–367.

Keating, B., & Kriz, A. (2008). Outbound tourism from China: Literature review and research agenda. *Journal of Hospitality and Tourism Management, 15*(1), 32–41.

Kim, Y. G., Eves, A., & Scarles, C. (2009). Building a model of local food consumption on trips and holidays: A grounded theory approach. *International Journal of Hospitality Management, 28*(3), 423–431.

Koenen, J. P., Chor, K. S., & Christianson, D. J. (1995). Effects of tourism growth on air quality: The case of Las Vegas. *Journal of Sustainable Tourism, 3*(3), 135–142.

Kourtidis, D., Šević, Ž., & Chatzoglou, P. (2016). Mood and stock returns: Evidence from Greece. *Journal of Economics Studies, 43*(2), 242–258.

Levy, T., & Yagil, J. (2011). Air pollution and stock returns in the US. *Journal of Economic Psychology, 32*(3), 374–383.

Li, W. (2004). Environmental management indicators for ecotourism in China's nature reserves: A case study in Tianmushan nature reserve. *Tourism Management, 25*(5), 559–564.

Li, J., Granados, N., & Netessine, S. (2014). Are consumers strategic? Structural estimation from the air-travel industry. *Management Science, 60*(9), 2114–2137.

Lim, C. (1997). Review of international tourism demand models. *Annals of Tourism Research, 24*(4), 835–849.

Lim, C., & McAleer, M. (2001). Monthly seasonal variations: Asian tourism to Australia. *Annals of Tourism Research, 28*(1), 68–82.

Li, Q., & Peng, C. H. (2016). The stock market effect of air pollution: Evidence from China. *Applied Economics, 48*(36), 3442–3461.

Martín, M. B. G. (2005). Weather, climate and tourism a geographical perspective. *Annals of Tourism Research, 32*(3), 571–591.

McKercher, B., Shoval, N., Park, E., & Kahani, A. (2015). The [limited] impact of weather on tourist behavior in an urban destination. *Journal of Travel Research, 54*(4), 442–455.

Mihalič, T. (2000). Environmental management of a tourist destination: A factor of tourism competitiveness. *Tourism Management, 21*(1), 65–78.

Moeran, B. (1983). The language of Japanese tourism. *Annals of Tourism Research, 10*(1), 93–108.

Mohan, M., & Kandya, A. (2007). An analysis of the annual and seasonal trends of air quality index of Delhi. *Environmental Monitoring and Assessment, 131*(1), 267–277.

Mok, C., & DeFranco, A. L. (2000). Chinese cultural values: Their implications for travel and tourism marketing. *Journal of Travel & Tourism Marketing, 8*(2), 99–114.

Nikkei Asian Review. (2017). *To beat Fukkushima's image problem, change the name: Hotelier*. Retrieved on August 7, 2017 via https://asia.nikkei.com/Features/Interview/To-beat-Fukushima-s-image-problem-change-the-name-Hotelier.

Papatheodorou, A. (2001). Why people travel to different places. *Annals of Tourism Research, 28*(1), 164–179.

Park, K. S., Reisinger, Y., & Noh, E. H. (2010). Luxury shopping in tourism. *International Journal of Tourism Research, 12*(2), 164–178.

People's Daily. (2011). *China grants 140 countries approved destination status*. en.people.cn/90782/7693106.html. (Accessed 28 November 2017).

Pizam, A., & Milman, A. (1986). The social impacts of tourism. *Tourism Recreation Research, 11*(1), 29–33.

Pope, C. A., III, Burnett, R. T., Thun, M. J., Calle, E. E., Krewski, D., Ito, K., et al. (2002). Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *Jama, 287*(9), 1132–1141.

Prayag, G., & Ryan, C. (2011). The relationship between the 'push'and 'pull'factors of a tourist destination: The role of nationality–an analytical qualitative research approach. *Current Issues in Tourism, 14*(2), 121–143.

Pritchard, A., Morgan, N., & Ateljevic, I. (2011). Hopeful tourism: A new transformative perspective. *Annals of Tourism Research, 38*(3), 941–963.

Ridderstaat, J., Oduber, M., Croes, R., Nijkamp, P., & Martens, P. (2014). Impacts of seasonal patterns of climate on recurrent fluctuations in tourism demand: Evidence from Aruba. *Tourism Management, 41*, 245–256.

Rosselló-Nadal, J. (2014). How to evaluate the effects of climate change on tourism. *Tourism Management, 42*, 334–340.

Rosselló-Nadal, J., Riera-Font, A., & Cárdenas, V. (2011). The impact of weather variability on British outbound flows. *Climatic Change, 105*(1), 281–292.

Saenz-de-Miera, O., & Rosselló, J. (2014). Modeling tourism impacts on air pollution: The case study of PM 10 in Mallorca. *Tourism Management, 40*, 273–281.

Saverimuttu, V., & Varua, M. E. (2014). Climate variability in the origin countries as a "push" factor on tourist arrivals in the Philippines. *Asia Pacific Journal of Tourism Research, 19*(7), 846–857.

Schwartz, J. (1994). Air pollution and daily mortality: A review and meta-analysis. *Environmental Research, 64*(1), 36–52.

Scott, D., Gössling, S., & de Freitas, C. R. (2008). Preferred climates for tourism: Case studies from Canada, New Zealand and Sweden. *Climate Research, 38*(1), 61–73.

Scott, D., Jones, B., & Konopek, J. (2007). Implications of climate and environmental change for nature-based tourism in the Canadian rocky mountains: A case study of Waterton Lakes national Park. *Tourism Management, 28*(2), 570–579.

Seaton, A., Godden, D., MacNee, W., & Donaldson, K. (1995). Particulate air pollution and acute health effects. *The Lancet, 345*(8943), 176–178.

Smith, K. (1993). The influence of weather and climate on recreation and tourism. *Weather, 48*(12), 398–404.

Stenlund, T., Lidén, E., Andersson, K., Garvill, J., & Nordin, S. (2009). Annoyance and

health symptoms and their influencing factors: A population-based air pollution intervention study. *Public Health, 123*(4), 339–345.
Todd, S. (2001). Self-concept: A tourism application. *Journal of Consumer Behaviour, 1*(2), 184–196.
Trauer, B., & Ryan, C. (2005). Destination image, romance and place experience—an application of intimacy theory in tourism. *Tourism Management, 26*(4), 481–491.
TravelDaily. (2017). *Reshuffle the OTA inventory: Who are the survivors of 2018?*. http://www.traveldaily.cn/article/119052. (Accessed 15 December 2017) (in Chinese).
Wang, Z. (2010). Factors that influence the growth of Chinese domestic tourism arrivals (1985–2007)–an empirical research based on the VAR model. *Asia Pacific Journal of Tourism Research, 15*(4), 449–459.
Wang, S. (2017). Leisure travel outcomes and life satisfaction: An integrative look. *Annals of Tourism Research, 63*, 169–182.
Wooldridge, A. (2006). *Measuring the mind: Education and psychology in England c. 1860-c. 1990*. Cambridge: Cambridge University Press.
Yang, Y., Liu, Z. H., & Qi, Q. (2014). Domestic tourism demand of urban and rural residents in China: Does relative income matter? *Tourism Management, 40*, 193–202.

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