The contingent equilibrium during imbalanced volcano tourism demand through fee estimation: An empirical analysis of tourism in Mt. Etna

Marco Platania
Department of Education Sciences
University of Catania
marco.platania@unict.it

Richard Sharpley
School of Management
University of Central Lancashire
rajsharpley@uclan.ac.uk

Marcella Rizzo
Department of Education Sciences
University of Catania
rizzom@unicy.it

Giovanni Ruggieri
University of Palermo
Department of Economics, Business, and Statistics
giovanni.ruggieri@unipa.it

Abstract
Volcanic sites can be considered strategic areas for conservation and protection policies, but such policies may involve considerable costs However, not only are volcanic sites often integral to the tourism industry and, hence, of potential significant benefit to local economies in general; entrance fee income from tourists can also contribute to management and conservation costs in particular. Nevertheless, seasonal variations in tourism demand, resulting in over-and under-tourism situations, may impact on both the level of income generated as well as on the sustainability of sites Therefore, based on a case study of Mt Etna in Italy, this study considers establishing appropriate entry fee levels for volcano areas. First, a logit model is applied to the relevant socio-demographic and site-specific variables. The entrance fees are estimated on visitors' willingness to pay and demand elasticity. Applying contingent valuation method (CVM), two groups of tourists (high and low season visitors) are identified and surveyed, with each group demonstrating different willingness to pay and elasticity levels. Rather than applying a single fee, different entrance fees for the two groups are found to generate a higher level of revenue for the park's economic equilibrium. In addition, the different entrance fees offer the potential to mitigate the peak effects of over-tourism and support demand during under-tourism, with clear sustainability consequences. The results, which confirm four hypotheses set about Mt. Etna, could facilitate decision-makers in determining a feasible balance between management costs, tourism demand characteristics and protection commitments.

Keywords
Volcanic sites; contingent valuation; volcano tourism; over-tourism; economic equilibrium, Mt. Etna

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1. Introduction

Volcanic sites are of great interest worldwide. They influence the natural and cultural landscape and are significant resources for education, leisure and recreation (Erfurt-Cooper et al., 2015). Almost 1,300 known active volcanoes exist around the world (Aquino et al., 2019) while numerous others are extinct. Each possesses unique characteristics and eruption histories (Lockwood et al., 2010), and many are popular tourist attractions (Erfurt-Cooper, 2010). Volcano tourism attracts over 130 million tourists in the United States, Japan, New Zealand, Italy and Spain alone (Erfurt-Cooper, 2011) and occurs in many other countries. Consequently, volcanic sites often represent a vital resource within the local tourism economy (Farsani et al., 2011; Stynes and Sun, 2005).

As non-renewable natural resources, volcanic sites require protection and conservation to maintain their integrity and attraction as tourist destinations. National laws and regional regulations are often implemented to protect the natural environment of these sites; for instance, many lies within or are designated as national parks, whilst others have protected area status. In addition to national boundaries and policies, UNESCO, as an intergovernmental institution, also contributes to preserving many volcanic landscapes (Strasser, 2002). More specifically, policymakers are often motivated to adopt restrictions and land use limitations. However, whilst the most effective policy might be to impose strict rules on accessibility to tourists, the potential economic contribution of tourism to reducing the public financial burden of funding site management must also be acknowledged (Bushell and McCool, 2007; Job et al., 2017).

Extensive academic attention has been paid to the role of entrance fees, both in contributing to the management costs of protected areas and as an effective tool for managing demand (e.g., Banerjee et al., 2018; Bushell, 2003; Font et al., 2004; Walpole et al., 2001). In particular, many studies have explored the relationship between entrance fees, visitors' willingness to pay (WTP) and levels of demand (e.g., Reynisdottir et al., 2008; Witt, 2019); although higher entrance fees are typically associated with a demand reduction, some willingness-to-pay studies reveal that there is potential to exercise higher fees to increase the income to support the management and conservation of protected areas. However, less attention has been paid to the relevance of entrance fees to volcano areas in general, whilst

seasonal variations in visitation to many volcanic sites, in particular, have not been considered. Visitation to many volcano sites is affected by seasonality and, consequently, fluctuations in income from tourism during the year present challenges for planning and management (Burbano and Meredith, 2021; Stojčić et al., 2022). To date, no research has been undertaken on the potential to employ a variable entrance fee system to volcanic sites (and, indeed, to other protected natural areas) to better manage and control variations in tourism demand while continuing to meet conservation and protection funding requirements.

The purpose of this study is to address this gap in the literature. Based on a case study of Mt. Etna, a volcano located in Sicily, it seeks to explore the relationship between three variables, namely (i) tourist demand, (ii) seasonality and (iii) tourists' WTP, to determine whether entrance fees can be manipulated to optimise income to support the management and conservation of volcanic sites.

The paper is structured in four parts. The first, the Volcano Tourism, and its main features, the aspects related to tourism and sustainability. Then the theme of entrance fees is explored for volcanic areas as a management and financing tool. The second part presents the case study of Mount Etna in Sicily (Italy), famous for its scenic beauty and its history and traditions. The third part defines the four research hypotheses and the logit model used to estimate the entrance fees. Finally, some tourism policies for the optimization of income maintain sustainable aspects. Applying a logit model to the relevant variables, seasonal entrance fee estimation is examined based on demand and WTP. The research identifies two groups of tourists (high-season and low-season) who display different levels of WTP and elasticity. Consequently, two levels of entrance fees are identified that provide optimal fee income equilibrium whilst also contributing to demand management for site sustainability. First, volcano tourism and the role of entrance fees are reviewed as a framework for the subsequent research.

2. Volcano tourism

Volcanoes and their wide range of landscapes and cultures are of significant international interest, stimulating substantial tourism demand (Dóniz-Páez, 2014). 'Every year, millions of tourists make active and dormant volcanic areas their preferred destination, either for recreational purposes including sightseeing, hiking, climbing, camping, or perhaps as an adventure trip' (Efurt-Cooper, 2021; Lopes-Gautier, 2010). Thus, volcano tourism is

'becoming increasingly popular in many regions of the world' (Heggie, 2009), as evidenced by the growing number of visitors to such sites in recent years (Aquino et al., 2019; Farsani et al., 2011; Heggie, 2009).

According to Erfurt-Cooper (2010), volcano tourism involves both exploring and studying active volcanic and geothermal morphologies and visiting dormant volcanic regions. Volcano tourism, therefore, refers to tourism based on the natural environment of volcanoes and on sustainable geo-resources that offer educational opportunities combined with recreational activities. As such, volcano tourism can be considered a sub-category of geo-tourism (Erfurt-Cooper, 2011; Heggie, 2009). The term 'geo-tourism' was coined in 2002 (Buckley, 2003) to distinguish it from other related forms of tourism, such as ecotourism or sustainable tourism. Geo-tourism is defined as tourism that supports or enhances the geographic character of a place, its environment, culture, aesthetics, heritage and its residents' well-being (Dowling, 2011; Newsome and Dowling, 2005). It encompasses cultural and environmental concerns regarding travel and tourism's local impact on communities, economies and lifestyles (Lew, 2002). Others consider volcano tourism to be related to wellness and spa tourism (Sigurdsson and Lopes-Gautier, 2000) and scientific tourism (Toulkeridis and Zak, 2010)

Nevertheless, as tourist attractions, some volcanoes are, in a sense, famous for being famous, such as Mt. St Helens in the United States, Mt. Fuji in Japan and, indeed, Mt Etna in Sicily. Moreover, recent years have witnessed increasing participation in volcano tourism as a form of extreme adventure tourism. Not only do adventurous tourists seek to explore volcanic attractions up-close, such as steam vents, volcanic hot springs or, for example, the 'fireworks' from eruptions on the Italian island of Stromboli, but there has also been a rising number of 'lava chasers' seeking to witness and capture images of eruptions (Ng, 2021). However, such tourism is not without risk. Between 2010 and 2020, at least 1,143 people perished in volcanic explosions (Ng, 2021), whilst twenty-two tourists lost their lives in a volcanic eruption on White Island, or Whakaari, in New Zealand in 2019 (Taylor, 2020). It is not surprising, therefore, that increasing attention is paid to the risks involved in volcano tourism (Bird et al., 2010; Nomura et al., 2004).

This paper examines the fundamental issue that, irrespective of definition, volcanic sites have collectively become increasingly popular tourism destinations with inevitable consequences for their fragile environments. As the next section discusses, this may be achieved by introducing and regulating entrance fees in response to seasonally varying levels of demand based on tourists' WTP.

2.1 Volcano tourism and entrance fees

Despite its growing popularity, volcano tourism has attracted relatively limited academic interest. Although the planning and management process of volcanic sites as tourism destinations may be complex and challenging, according to Aquino et al. (2019), research has focused primarily on classifying the characteristics of volcanoes and their value for tourism planning and development in different areas (Moufti and Németh, 2013; Wang et al., 2014; Zangmo Tefogoum et al., 2014). In other words, volcano tourism is considered a potential strategy to attract visitors to support or grow local economies (Bird et al., 2010; Heggie, 2009). In contrast, less attention has been paid to visitor management strategies in general and to the role of entrance fees in controlling demands to respect the volcano environment and contribute to site management costs.

The challenges in financing the conservation and management of natural protected sites through public funds have long been recognised (Lal et al., 2017; Mitchell et al., 2013; Whitelaw et al., 2014), with the acquisition of sufficient funds being a persistent concern (Anser et al., 2020; Nassani et al., 2019), especially for destinations where nature-based tourism is the primary resource. Hence, some countries, such as the United States and Canada, have been traditionally charging entrance fees in parks and other protected areas (Sharpley and Sharpley, 1997). It is now acknowledged that tourism may be a valuable source of funding to rebalance the management costs of such areas, particularly volcanic regions (Banerjee et al., 2018; Burbano and Meredith, 2021; Bushell, 2003; Font et al., 2004; Walpole et al., 2001). Specifically, entrance fees are considered a viable means of generating such revenue (Wang and Jia, 2012), leading to the public recognition about the need to implement an entrance fee policy at natural attractions and protected areas, including volcanic parks, to offset any decrease in public funds for site conservation and management (Eagles et al., 2002).

Given the limited economic resources available combined with the typically high costs associated with managing and conserving natural areas, entrance fee policies aim to maximise the income accruing from tourism activity. Consequently, several studies have sought to analyse tourists' WTP to visit natural parks or other protected areas to establish a viable level of entrance fees to reflect management aims (Mayer, 2014; Platania and Rizzo, 2018; Reynisdottir et al., 2008; Takyi and Seidel, 2017). However, even if an acceptable or appropriate entrance fee is identified to generate an economic contribution from tourism, this often does not guarantee financial equilibrium in terms of funding for conservation and

management owing to, for example, seasonal variations in demand manifested periods of so-called over-tourism (with environmental consequences) and under-tourism (with financial impact). Such an equilibrium, that balances tourism activity and income (taking seasonal demand variations into account) levels to maximise the contribution of tourism to management and conservation costs, is conceptualised in Figure 1.

More specifically, sustainable land use is critical in volcanic sites (Patti, 2013). The need to prioritise the maintenance of their environmental integrity by regulating or even excluding tourism demand has long been acknowledged but, arguably, this challenge is more evident in volcanic areas where tourists are excessively concentrated in time and space (over-tourism) threatening the constraints of sustainability and protection (Machado et al., 2021). In contrast, 'under-tourism' in the low season, whilst not threatening the natural environment, will manifest in lower income from entrance fees.

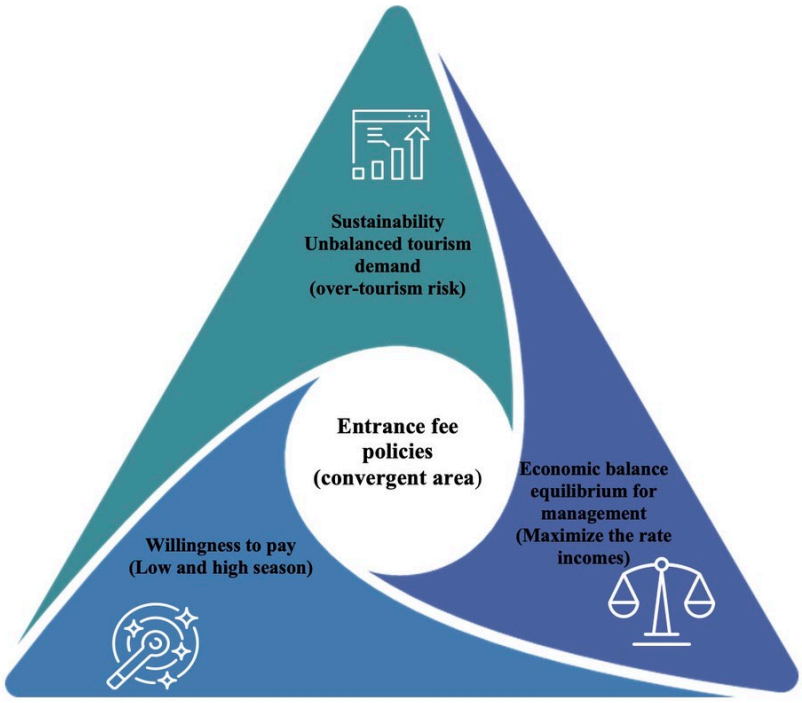

Figure 1: Conceptual framework of the equilibrium of tourism activity and income

To address these challenges, entrance fees to natural attractions, such as volcano parks, can be an effective means of controlling visitor numbers in the high season when the concentration of tourists may negatively impact the site (Reynisdottir et al., 2008). It has recently been proposed that introducing local taxes or tariffs to control and limit demand

might address this problem (Nepal and Nepal, 2021). As such, fee levels could be set to adapt tourism flows to reflect the environmental capacities of a volcano site (Candela et al., 2009). When demand is high, some tourists may be more willing to pay a fee to visit, but, at the same time, a higher fee level may discourage visitors, thereby reducing the pressure on tourism (Lindberg and Johnson, 1997). In contrast, tourists visiting during periods of lower demand may be unwilling to pay higher entrance fees; for these tourists in low or under-tourism scenarios, differential (lower) fees can become an additional element of attraction or an incentive to visit. Additionally, if a volcanic area is a unique attraction, tourists may have different motivations to visit the destination. In this way, higher or lower tourist concentrations give rise to other considerations in their WTP and holiday decision-making process.

Hence, based on Mount Etna in Sicily, this paper reflects on the three elements fundamental to establishing an appropriate entry fee policy for tourism in volcano areas, as conceptualised in Figure 1. Specifically, through research exploring the WTP for an entrance ticket, the paper demonstrates that the best choice in economic and sustainability terms is to charge two different fees according to the tourism season. In this way, both the economic and tourist flow objectives and their impact on the environment are achieved.

To summarise, the need to implement containment and control policies for volcanic areas is related to fluctuations in tourism demand and the motivations of different groups of tourists, which may also be determined by seasonality. Simultaneously, managers need to attract sufficient tourists to achieve economic equilibrium – balancing income from tourism with site management costs within the constraints of environmental capacities and sustainability goals. This balance is achieved through a fee regime addressed in this study.

2.2 Study area of volcano tourism

Mt. Etna and the more expansive Etna National Park is situated to the east of the island of Sicily, lying off the south coast of Italy (Figure 2). Designated in 1987, it was the first national park established in the Sicily Region, covering 59,000 hectares, and encompassing 20 municipalities with approximately 50,000 inhabitants. The park was established to protect the natural environment and surrounding landscape of the largest active volcano in Europe. It is managed by the Etna Park Authority and is subject to the control and supervision of the regional government. In 2013, UNESCO declared Mt. Etna a World Heritage Site. Today, it is an important centre for international research with a monitoring system connected to the

most critical volcanic areas globally and is known, studied and visited by numerous scientists, scholars and geo-tourists.

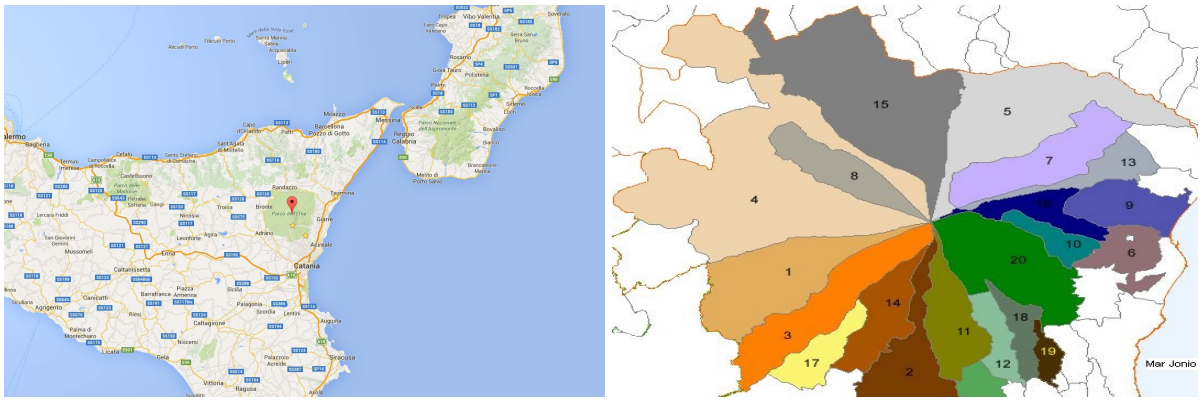

Figure 2: Mt. Etna Volcano: location and territories

Tourist facilities at Etna include accommodation (hotels, shelters), car parks, restaurants, cafes, cable cars, chair lifts (for skiing tourism) and excursion information points. An estimated 300,000 tourist nights are spent annually in the Etna volcano area.

However, tourist arrivals on the island are highly seasonal, with the number of tourists varying considerably during the year. As shown in Figure 3, tourist arrivals are more concentrated in the spring and summer months, identified as high season tourists (HST), with lower numbers in autumn and winter, termed as low season tourists (LST).

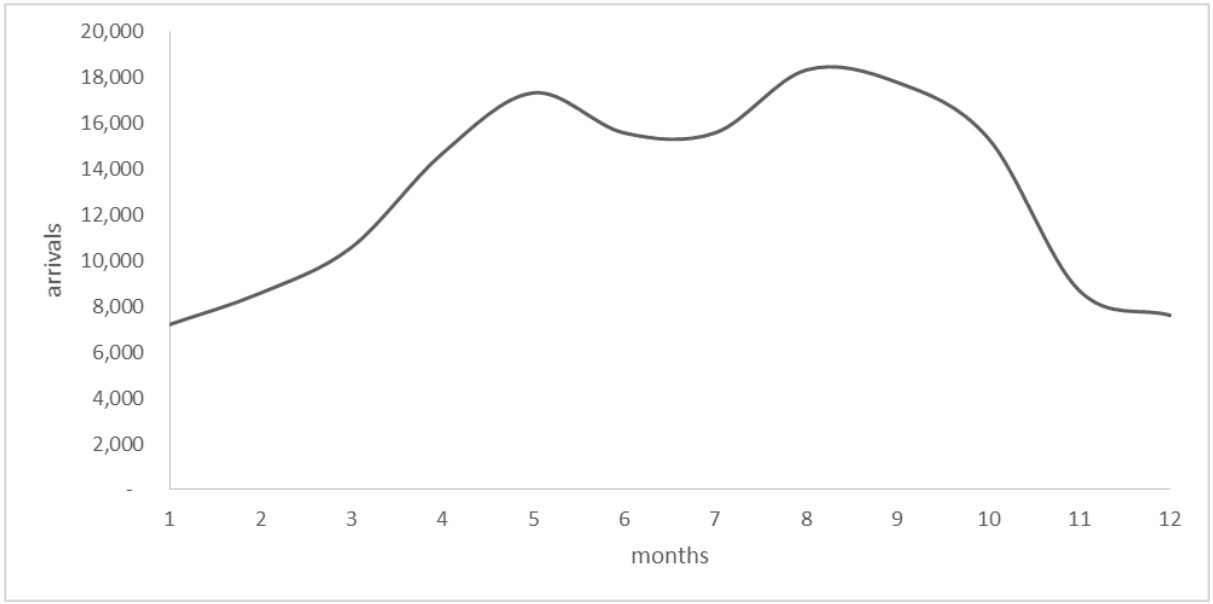

Figure 3: Etna – Monthly distribution of tourism
Source: Compiled by the authors from the Osservatorio Turistico Regione Siciliana (Sicily Region Tourism Observatory), 2018.

Seasonality is a typical tourism phenomenon on islands, resulting in social, economic and carrying-capacity effects. Typically, the high season capacity tends to be exceeded, manifested as over-tourism. At this time, many tourists are concentrated in the hospitality areas and at the starting point for excursions, thus producing an anthropic load with evident disturbance to the delicate environmental balance (Parco dell'Etna, 2017).

More specifically, the various activities undertaken by HST, including mountain biking, quad biking and off-road tours, impact significantly on the environment. At the same time, the flow of organised tourism has negative consequences for nearby small towns, with tourist buses travelling through them to reach popular park sites. A trivialisation effect is also often linked to poorly prepared tourists in terms of equipment and knowledge of the volcano. In addition, the increase in tourist pressure has activated traditional crowding-out effects (Privitera, 2019), highlighting the centrality of over-tourism in a specific period (Sturiale et al., 2020). Thus, the challenges faced by Etna Volcano Park suggest that the objective of guaranteeing the sustainable development of the local economy (Qureshi et al., 2016) could be achieved if these tourist activities are managed and regulated to balance demand (and income) over the year (Parco dell'Etna, 2017). The Sicily Region has recently introduced a policy of charging entry fees for visitors to protected areas on the island; the ticket sales revenue is intended to support the maintenance of protected areas and provide more services for tourists. To date, however, this policy has not been fully implemented in the management of the Etna area because of the limited knowledge of volcano area management.

3. Research hypotheses

This study builds upon the literature review discussed above, seeking to establish whether the introduction of differentiated entrance fees, instead of a single fee, may satisfy the need to achieve an economic balance between tourism income and management costs at Etna Volcano Park. Additionally, the study seeks to identify policy implications for the area's sustainability.

The starting point is to verify whether fluctuations in tourism demand underlie tourists with different characteristics. With H_1, the model verifies the first working hypothesis.

H_1: Seasonality in tourism in the volcanic site identifies two categories of tourists.
Verifying H_1, we expect to have HST and LST groups. Therefore, if H_1 is verified, we can expect a different group reaction to their WTP.

H_2: The presence of high- and low-season groups of tourists demonstrates a different WTP for each.
H_2 must verify whether the presence of different groups generates a distinct WTP.

With evidence of H_2, H_3 analyses the setting of two entrance fees, one for each tourist group (HST and LST), that could maximise incomes for park management, thereby creating an economic equilibrium.

H_3: The entrance fees for LST and HST increase the park's income and economic equilibrium.
If H_3 is satisfied, it must be verified whether applying different fees contributes to the containment of over-tourism in the high season and fosters tourism in the low (under-tourism) season.

H_4: Two different entrance fees mitigate the over-and under-tourism effects.
This study aims to verify the four hypotheses in the case of Mt. Etna Volcano using a scientific methodology.

4. Material and methods

To address the research questions, it is necessary to employ a methodology that estimates respondents' perceptions of the payment of an entrance fee to the park. There is consensus in the literature that WTP should be explored through the contingent valuation method (CVM).

CVM is a survey-based approach to valuing non-market goods and services. It has been applied in various disciplines, such as ecological economics, tourism, health economics and cultural economics (Choi et al., 2010; Correia et al., 2007; Latinopoulos et al., 2016; Lindberg et al., 1999; Morey and Rossmann, 2003; Platania and Rizzo, 2018; Reynisdottir et al., 2008; Wang and Jia, 2012). Mitchell and Carson (1989) describe this as a method of directly asking people what price they would attribute to a service if there was a market for it. The CVM estimates values depending on the respondents' hypothetical market situation or scenario before enquiring the amount they are willing to pay. Tisdell (2006) supports the application of this economic indicator to natural attractions and several studies have applied this methodology to protected areas. For instance, Adams et al. (2008), using the CVM to estimate the WTP in protected areas of Brazil, state that this method can help formulate

public policies since it quantitatively highlights the environmental values that a community attributes to a public good.

In a similar vein, Han et al. (2011) analyse the WTP for natural reserves. Identifying that most respondents are willing to pay for the conservation of the environment, they suggest a fundraising program to alleviate the financial hardships that natural sites must face.

Reynisdottir et al. (2008) also show how CVM is effective in estimating the entry fee to a natural attraction, though emphasise that a tax payment policy must not hinder the objective of promoting access. Therefore, the final estimate must be a compromise between the funds acquired through the entrance tickets and the reduced number of visitors. Finally, Togridou et al. (2006) demonstrate that the amounts estimated through the CVM are based on complex assessments that include the relationship between value in use and non-use of resources.

Despite these positive outcomes, the CVM has been criticised, especially with regards to the ultimate objective of the approach. For example, Neuteleers and Engelen (2015) argue that a method based on monetary valuation alone does not adequately measure how people value an environmental good. Similarly, Diamond and Hausman (1994: 62) affirm that the CVM 'is a deeply flawed methodology for measuring non-use values, one that does not estimate what its proponents claim to be estimating'. More generally, from a methodological perspective, the main criticisms of the CVM are the risks of compliance and strategic biases (Mitchell and Carson, 1989).

The WTP determines the probability between two choices, considering individual characteristics. In the case of dichotomous choices, individuals have utility functions (U) which have income (Y) and a set of conditioning factors (S) as arguments (Amirnejad et al., 2006):

$$U\,(Y;\,S)$$

Everyone compares an offer (A), which they could contribute towards the continued existence of environmental good. According to Hanemann (1984) and Lee and Han (2002), the individual will accept the offer to maximise their utility under the following conditions:

$$\boxed{U(1, Y - A; S) + \varepsilon_1 \geq U(0, Y; S) + \varepsilon_0}$$

U is the indirect utility which is assumed to equal the utility u. Y is income, A is an offer (admission fee or tax), S denotes the socio-economic characteristics affecting individual

preference, and ε_0 and ε_1 are identically and independently distributed random variables with zero means. Given the binary choice question for WTP the entry fee (dependent variable), we used logistic regression to determine the significant factors affecting visitors' WTP in high and low seasons. The probability (*Pi*) that the individual will accept an offer (*A*) can be expressed as the following logit model:

$$Logit\ P_i(Y = 1) = \beta_0 + \beta_1 X_1 + \cdots . + \beta_n X_n + \varepsilon_i$$

where *Y* is the dichotomous-choice dependent variable (the response to the WTP question as Yes = 1 and No = 0), β_0 is the intercept, β_n is the regression weight for X_n, an individual characteristic (associated with holiday and socio-economic attributes), and ε_i is the residual with a mean of zero. Practically, in addition to the proposed entry fee, visitors' WTP is affected by socio-demographic and site-specific variables derived from the literature (Alpízar, 2006; Baral et al., 2008; Bowker et al., 1999; Carlsson and Johansson-Stenman, 2000; Clinch and Murphy, 2001; Lindberg, 1991; Mmopelwa et al., 2007; More and Stevens, 2000; Pandit et al., 2015; Platania and Rizzo, 2018; Reiling et al., 1992; Reynisdottir et al., 2008; Walpole et al., 2001). The X_n explanatory variables are gender (GEN), age (AGE), educational background (EDUC), nationality (ITA), family size (FAM), income (INC), first-time visit to Etna Park (FIRST), the interest of hiking in the mountains (TREKK), and a score of visitors' environmental concerns at Etna Park, related to the destination choice (ENVIROM), history (HIST), entertainment (ENTER), sports activity (SPORT), heritage (TRAD), and food and wine products (TYPIC). These last variables are considered because of the area's designation as a UNESCO World Heritage Site and as they are the basis of promotional activities carried out by the regional government.

The logit model was estimated using the most common technique, the maximum likelihood estimation method (Amirnejad et al., 2006). Statistical analysis of variables, mathematical calculations, and estimation of the logit model parameters were performed in SPSS (Statistical Package for the Social Sciences).

The values elicited from the WTP were aggregated to form a demand curve (Greiner and Rolfe, 2004; Gupta, 2016) for the high and low season's groups. Following Armbrecht (2014), the WTP amount was then used based on the average value of each interval to build the demand curve.

The effect of introducing a ticket on tourist visitation to Etna Park in high and low seasons can be better captured by the demand curve and its elasticity which measures the

effectiveness of price mechanisms in reducing visitation (Greiner and Rolfe, 2004; Seetaram et al., 2018;). The effect of entrance fees on the sites' demand was analysed using simple regression analyses (Reynisdottir et al., 2008; Willis, 2003).

4.1 Surveys

The survey was conducted in two stages. The first was carried out during the summer of 2018, in June, July and August for the HST, and the second during autumn, in October and November, for the LST. Questionnaires were collected from several tourist areas near the site through systematic random sampling (Kish, 1965). This procedure requires the interviewer to predetermine and select population members regularly. To avoid sampling distortions, the timing and location of the interviewers were established, and the interviews were done prior to entering the park, on different days of the week, including weekdays and holidays. The interviewers were located near the places of departure (for example, at the tourist bus station) or at tourist arrival points. Considering the different types of travel groups, a 'one in every ten' selection procedure was followed. Overall, 353 HST and 110 LST questionnaires were collected.

The questionnaire comprised semi-structured and multiple-answer questions in three sections. The first section sought to elicit data regarding the respondents' visit to the park (purpose, length of stay, activities, discovery, training) and their perceptions of the park based on the communication developed by the local government authority to promote Sicily as a destination. The second section explored respondents' WTP for a park ticket. A scenario, which included sufficient and accurate information about the volcano site, was presented that allowed respondents to express their preferences to estimate their WTP. The survey contained a preference elicitation question on the provisional price of €5.00 (the average fee currently applied in the region's protected areas) and an open-ended question asking the maximum price level respondents would be prepared to pay. In addition, a supplementary question was provided for those who were unwilling to pay, asking them to express the main reason for their reluctance. Finally, the purpose of the third section was to generate descriptive socio-economic data regarding the interviewed sample, including age, income, family size, and educational background.

Responses to binary choice questions, such as WTP, entry fee, age and gender, were coded as 0 or 1. In contrast, the responses to Likert-scale questions were coded using a 7-point scale (where 1 = strongly disagree and 7 = strongly agree). A pre-test was conducted before

starting the survey to ensure that respondents understood the questions correctly, including the scenarios used in the application of CVM.

From a methodological point of view, after the first phase of loading and data cleaning, descriptive statistics were carried out for the first data analysis. The logistic regression model was estimated with SPSS 17.0.

5. Results

The research considers the socio-demographic attributes of the two samples, whose non-response rate was near zero and non-response was minimal. A university degree was the median education level for females in the HST group. The average age of visitors was 44 years. Approximately 68% were international tourists and 40% were families with children. Only five of the 109 national tourists were from nearby cities. Employed people, self-employed people and students comprised 50%, 19% and 6%, respectively. On the other hand, the LST group had a more significant proportion of males Finally, and perhaps unsurprisingly, the group had a more significant share of national tourists (60%) than HST.

Table 1 provides the summary statistics for WTP. The main reasons given for adverse responses to the ticket scenario were related to the respondents' perception that it was costly and due to the natural environment. The small proportion of HST respondents who found the cableway too high believed that they had already paid enough.

	HST		*LST*	
	N	*%*	*N*	*%*
Willingness to pay 5 Euros as ticket price	*267*	*75.65*	*52*	*47.3*
Non-willingness to pay	*83*	*23.51*	*58*	*52.7*
n.r	*3*	*0.84*	-	-
Reasons for zero WTP				
It is too expensive	*27*	*32.14*	*7*	*12.07*
The Etna Park is a common good	*20*	*23.81*	*19*	*32.76*
I must also pay for the cableway	*9*	*10.71*	-	*0.00*
Other	*28*	*33.33*	*10*	*17.24*
n.r.	*0*	*0*	*22*	*37.93*

Table 1: HST and LST willingness to pay and reasons for zero WTP

The variables shown in Table 2 were subjected to logistic regression analysis (Hosmer and Lemeshow, 2004) to estimate their effect on the WTP for each respondent in each group (HST and LST).

We used backward selection to identify the optimal set of independent variables. This method estimates the model using all variables, removing the least significant variable (Jones et al., 2015). Thus, the application procedure reveals more robust relationships between the independent variables associated with the holiday, socio-economic attributes, and the dependent variable; the strongest statistically dependent variables were established.

Variable	*HST*		*LST*	
	Mean	*Standard deviation*	*Mean*	*Standard deviation*
Willingness to Pay (WTP)	*0.760*	*0.428*	*0.472*	*0.502*
Bid value perception	*10.180*	*10.711*	*6.40*	*4.547*
Gender (GEN)	*0.482*	*0.500*	*0.672*	*0.471*
AGE	*44.000*	*15.811*	*45.381*	*16.030*
Educational level (EDUC)	*2.560*	*0.615*	*3.363*	*0.554*
Annual family income (INC)	*2.88*	*1.306*	*0.909*	*1.121*
Composition number of family (FAM)	*2.142*	*0.991*	*2.50*	*1.419*
First time getting to know the Etna Park (FIRST)	*0.836*	*0.371*	*0.727*	*0.447*
Environment (ENVIROM)	*5.820*	*1.612*	*5.400*	*2.161*
History (HIST)	*5.590*	*1.538*	*5.294*	*2.093*
Entertainment (ENTER)	*4.690*	*1.951*	*4.084*	*2.604*
Sport activity (SPORT)	*3.540*	*2.282*	*2,042*	*2.499*
Heritage (TRAD)	*4.880*	*1.902*	*4.452*	*2.521*
Food and wine products (TYPIC)	*5.390*	*1.898*	*4.489*	*2.808*
Nationality (ITA)	*0.311*	*0.464*	*0.60*	*0.492*
Hiking on the volcano (TREK)	*0.209*	*0.407*	*0.509*	*0.502*

Table 2: Variable description and summary statistics by visitor category

The model also tested the multicollinearity between independent variables using the correlation matrix. There were no problems with multicollinearity. The Hosmer-Lemeshow test also assessed the model's suitability. The diagnostics of the estimated model were further developed using the pseudo-R-squared statistic. Both tests provided encouraging results.

Table 3 presents the regression coefficient estimation results for the two groups. In summary, for the HST sample, WTP was positively affected by FIRST, TRAD (Heritage), and ITA (nationality), while AGE and TYPIC had a significant negative influence on WTP. Specifically, WTP was higher for younger people, and lower for respondents who chose Etna Park for food-related reasons. FIRST, TRAD and ITA influence the WTP significantly.

Regarding the variable FIRST, the WTP increases if the tourist is a first-time visitor to Etna Park. Heritage (TRAD) is an essential variable in destination choice that influences WTP. Finally, domestic tourists demonstrated a greater WTP than international tourists.

In the LST sample, visitors' WTP in the low season seems to be determined by variables linked to the economic aspect and passion for the mountains. They tended to be local visitors

(60% were national, while in the group of high season visitors, they accounted for 30.9% of the sample) who had visited the park on several occasions.

Variables	β_C	*S.E.*	*Odds ratio*	*p.*
		HST (*)		
AGE	*-0.022*	*0.009*	*0.979*	*0.013*
FIRST	*0.772*	*0.349*	*2.164*	*0.027*
TRAD	*0.219*	*0.087*	*1.245*	*0.012*
TYPIC	*-0.139*	*0.084*	*0.870*	*0.096*
ITA	*0.957*	*0.344*	*2.604*	*0.005*
Constant	*0.944*	*0.665*	*2.570*	*0.156*
		LST (**)		
TREK	*1.525*	*0.556*	*4.596*	*0.006*
INC	*0.505*	*0.283*	*1.658*	*0.075*
ENTER	*0.239*	*0.120*	*1.270*	*0.047*
Constant	*-2.526*	*0.835*	*0.080*	*0.002*
	(*)		*(**)*	
	−2 Log likelihood = 334.932		*−2 Log likelihood = 80.925*	
	Cox and Snell R^2 = 0.064		*Cox and Snell R^2 = 0.203*	
	Nagelkerke R^2 = 0.096		*Nagelkerke R^2 = 0.271*	

Table 3: Determinant of WTP function

The WTP is linked to the demand curve, and the study of the elasticity of demand may capture the effect of introducing an entrance fee. The demand curve was created by plotting the aggregate number of visitors in the two groups for each rating level. A demand elasticity larger than one means that the relative decrease in demand is higher than the relative increase in price and, thus, the market is price elastic (Greiner and Rolfe, 2004). For the HST group in Table 4, demand is inelastic with a value less than 1 and becomes elastic with a value more than 1 from a critical value of €20.00.

Bid price (median values)	*Number of respondents*	*%*	*Elasticity*	*Expected visitors (*) HST (**)*	*Revenue*
0	*0*	*-*	*na*	*27.230*	*-*
5	*129*	*100,00*	*13,8*	*18.138*	*90.692*
10	*98*	*52,06*	*3,9*	*15.302*	*153.016*
15	*16*	*15,36*	*2,0*	*12.465*	*186.974*
20	*5*	*9,36*	*1,1*	*9.628*	*192.565*
25	*7*	*7,49*	*0,6*	*6.792*	*169.790*
30	*1*	*4,87*	*0,3*	*3.955*	*118.647*
50	*12*	*4,49*	*-0,1*	*-7.392*	*-*
(*) 70% of total arrivals (**) June, July, and August months					
Bid price (median values)	*Number of respondents*	*%*	*Elasticity*	*Expected visitors * LST ***	*Revenue*
0	*0*	*-*		*16.693*	*-*
5	*34*	*100,00*	*6,6*	*13.097*	*65.487*
10	*14*	*34,62*	*1,5*	*8.411*	*84.106*
15	*1*	*7,69*	*0,5*	*3.724*	*55.856*
20	*3*	*5,77*	*0,1*	*-963*	*-*
(*) 70% of total arrivals (**) November and December months					

Table 4: Entrance fees and elasticity for HST and LST

The tourists expected amounted to about one-third of the estimated total. Moving on to the LST, the elasticity value close to 1 corresponds to the entry bid of €10.00, at which the value of the revenue for the low season months (November and December) reaches the maximum value, with tourists equivalent to 50% of the estimated total).

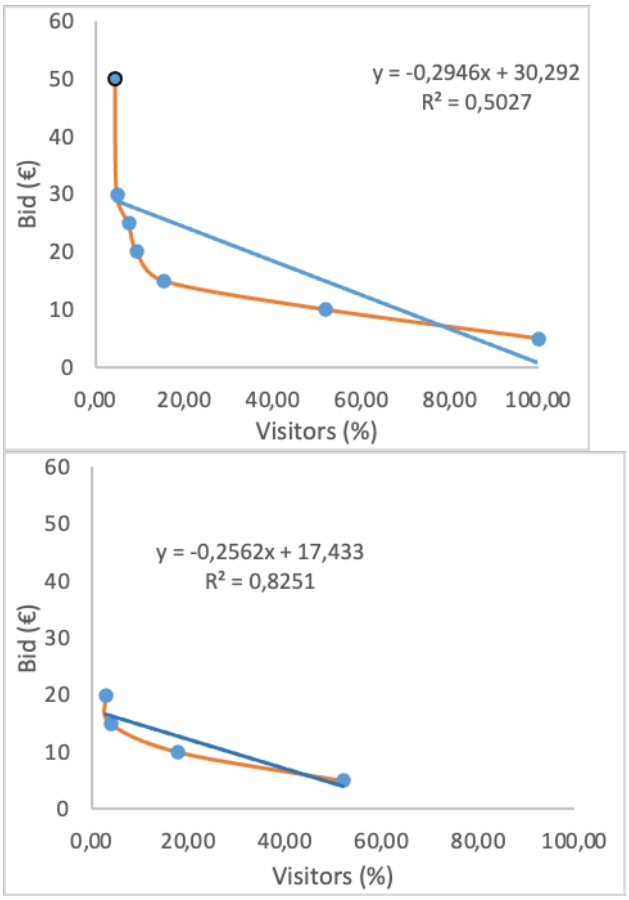

Figure 4: Demand curves and regression lines for HST and LST

6. Discussion

Volcanic areas and other natural attractions are typically affected by seasonality, often creating over-and under-tourism situations. Hence, the first research hypothesis proposed the presence of groups of tourists with different characteristics according to the season. The research revealed that the two groups possessed different characteristics, thus confirming H_1. Moreover, these different characteristics were related to WTP. Specifically, amongst the HST group, WTP was associated with the TRAD (heritage) and FIRST variables; conversely, the LST group had different motives related to trekking, walks and entertainment activities that determined a different WTP. Notably, in the latter group, younger people had a greater WTP

because of their higher sensitivity to environmental issues (AGE). As such, unlike previous studies which overlook seasonal variations in the characteristics of visitors – tourists' motives and expectations are typically considered to be constant throughout the year - this research advances knowledge and understanding of the relationship between seasonal variations in tourists and their WTP, with important implications for fee income generation and visitor demand management. In other words, although the previously limited research suggests that visitor numbers at natural areas may be managed by the level of fees charged, this is the first study to establish an explicit link between seasonal distinctions in tourists' characteristics and their varying WTP.

The second research hypothesis concerned verifying a different WTP for the two groups of tourists. The results confirmed this hypothesis; more than two-thirds of the HST respondents were willing to pay the proposed fee while less than half of the LST group were willing to do so. Specifically, high-season tourists were willing to pay between €5.00 and €80.00, while low-season tourists were amenable to paying between €2.00 to €20.00. Considering elasticity values, the results suggest that the entrance fee could range between €20.00 and €25.00 for the HST and between €10.00 and €15.00 for the LST. Again, this is an important outcome not previously identified in the literature, providing the basis for establishing seasonally adjusted entrance fees that reflect variations in WTP amongst tourists.

Although earlier studies have sought to identify tourists' WTP as a basis for establishing a viable entrance fee to meet management objectives, none have considered variations in fees to optimise income over the year to achieve balanced funding for natural area funding. Hence, H_3 proposed that, based on elasticity results, different entrance fees for HST and LST will increase the park's income and contribute to economic equilibrium. The revenue calculated at different elasticity values (Table 4) was higher when the fee is fixed in the proximity of elasticity of 1, between €20–25 for the HST and €10–15 for LST. Hence, two different fees ensure a higher level of revenue for the park's economic equilibrium than a single tariff. Therefore, H_3 is confirmed.

Finally, the different entrance fees could alleviate the adverse effects of over-tourism and under-tourism. This supports previous studies that identify entrance fees as a viable means of managing tourist demand within a natural area's environmental carrying capacity and confirms H_4. Again, however, this research adds an additional dimension to the literature by establishing a model for entrance fees that not only achieve sustainability objectives but contribute to a site's financial equilibrium.

7. Conclusions

The overall aim of this study was to determine the extent to which visitor entrance fees to a popular volcano site might be seasonally adjusted in response to variations in demand in order to optimise tourism's contribution to the site management and conservation costs, whilst achieving a more even distribution of tourists throughout the year. More specifically, based on a case study of Mt. Etna in Sicily, the research sought to establish the potential range of high- and low-season entry fees that tourists would be willing to pay (reflecting their expectations and motives for visiting) in order to achieve an equilibrium between optimising revenues for the park's management and maintaining environmentally sustainable levels of demand.

Despite the limitations of the research, which primarily entail the relatively limited sample size and, hence, the representativeness of the results, as well as the recognised limitations of the CVM discussed, two principal conclusions can be drawn. First, the study revealed that WTP an entrance fee (and the level of that fee) varied between visitors at different times of the year, reflecting the differing characteristics and motives of these two groups. Broadly speaking, high season tourists were, unsurprisingly, primarily international holidaymakers on a first-time visit; Mt. Etna is amongst the most popular tourist attractions in Sicily and is globally well-known. Conversely, tourists in the low season were predominantly local domestic visitors often drawn to the park repeatedly to enjoy the natural environment. The greater WTP amongst high season visitors undoubtedly reflects their expectations and motives and the site's significance as a tourist attraction. For low season visitors, in contrast, the park is predominantly seen as a local environmental resource and hence, to an extent, a common good, for which entrance fees should be low or not charged. Thus, WTP is directly related to the differing, seasonally defined characteristics of tourist groups, implying that any fee policy should be based upon a comprehensive understanding of the site's visitor markets.

Second, high season tourists revealed a willingness to sometimes pay significantly higher entrance fees than low-season tourists. Based on elasticity calculations, these translated into high (€20–25) and low (€10–15) season ranges of entrance fees that together would generate more revenue overall than a single, static tariff throughout the year. In other words, the research reveals that entry fees can be manipulated to optimise revenue for site management, despite the likelihood that higher fees will reduce demand in the peak season. Indeed, such a reduction in demand would limit the environmental impacts of tourism in the high season, contributing to the environmental sustainability of the site.

Overall, then it can be concluded that, in theory, a variable fee policy based on the seasonality of tourism demand at Etna National Park may be an effective tool in both optimising revenues and maintaining tourist numbers at a more sustainable level during the high season at volcanic areas. Whether demand can be manipulated practically in such a way, with alternative or additional tools serving as weapons in the visitor management armoury, remains to be examined. Also, further research is necessary to determine the effectiveness of variable entrance fees in the management of other natural protected sites. Nevertheless, this paper has demonstrated that the challenge of funding the management and conservation of natural protected sites, such as volcanos, that are popular tourist attractions, can be addressed through a variable entrance fee policy.

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