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# Valuing Attributes of Ski Resorts Based on the Ski Tourists' Satisfaction

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**Abstract.** Skiing tourism is a popular sport and leisure activity worldwide. Numerous studies have looked at various issues related to ski tourism, including aspects of ski tourists' health, sociology, psychology, environmental pollution, and marketing. However, few studies made efforts on valuing the attributes of ski resorts and managerial features. To fill in the gap, this study attempts to value both the ski resort attributes and management factors using the skiing tourists' satisfaction (STS) method. Three models - ordered logit, ordered probit and OLS were used in estimating the economic values of the ski resort attributes and management activities. The revealed value information could carry some insightful implications for strategic decision making on ski tourism industry development and effective ski resort management not only in China but around the world.

**Keywords:** ski tourists' satisfaction; ski resort attributes; ordered logit model; willingness to pay .

## 1. Introduction

Participation in sports leisure activities, such as skiing, has some notable benefits, including enhancement of physical and mental health, subjective well-being (SW), and quality of life [1]. Thus, increasing participation in skiing tourism to meet the desire for a better life and promote well-being is one of China's primary policy objectives[2]. A huge potential market exists for ski tourism in China. Fully understanding the interrelationship between ski tourists' satisfaction and ski resort attributes should be deemed a prerequisite for a successful ski resort operation.

Konu et al. (2010) identified four factors determining the attributes of the most valued ski resorts in Finland: downhill skiing facilities; cross-country skiing facilities; restaurants and social life opportunities; and spa services[3]. Hall et al. (2017) used a structural equation model (SEM) to analyze the relationship between attribute satisfaction, overall satisfaction and behavioural intentions[4]. They found that different tourist segments were motivated by different attributes, but it is not necessary for all attributes to be satisfied in order to achieve overall satisfaction and positive behavioural intentions. Bonnefoy-Claudet and Ghantous (2013) also applied a SEM to skier survey data in Alpine resorts to analyze the moderating effects of three important factors in the attribute performance-overall satisfaction-loyalty relationships: lifestyle, consumer spending and customers' skiing skills[5]. Zekan and Mazanec (2022) found that configurations of resort attributes lead to some level of overall satisfaction[6]. Identifying the attributes most valued by tourists generates a tool for developing strategies able to enhance the competitiveness of that tourist destination[7].

In addition, our literature review found that skiing tourism has also garnered other widespread research interests such as wealth [8], marketing [9], pricing of ski lift tickets [10], influence of weather conditions on alpine ski visits [11], environmental pollution [12,13], spirituality[14], life satisfaction [15， 16], and happiness[17], among others. However, very little is known about economic values of the ski resort attributes and how to value them. To fill in the gaps, this study aims to value the ski resort attributes using a ski tourists' satisfaction (STS) model. The evidence was provided through a survey of Chinese ski resort visitors. Specifically, we collected data on ski-resort attributes and self-reported levels of satisfaction of ski visitors during their visits to the ski

sites. The data of ski-resort attributes was focused on the natural resources and environments, ski facilities and managerial activities.

## 2. Methodology

### 2.1 Study Area

As ski resorts are mainly located in northern China, the sampling area was mainly focused on this region, covering a total of 11 provinces and autonomous regions. Statistics showed that more than 600 ski resorts were present in the areas with diverse distributions of landforms and sizes. We selected at least 30 ski resorts as the sample for analysis. The process of locating ski resorts involved online searches, reading study reports, and phone calls. Initially, more than 50 ski resorts were identified as our survey candidates based on the annual number of ski tourists visiting an individual ski resort. After making phone calls to the personnel at each selected facility, 31 site managers agreed to help with our data collection. In general, all the selected ski resorts were the most popular ones in China. On average, there were 5,904 ski tourists per day and 204,703 at each ski site, according to the 2021-2024 skiing season statistics.

### 2.2 Skiing Tourist Satisfaction (STS) Model

A leisure skier satisfaction model can be structured in Eq. (1):

$$TS_{ij} = F\left(EA_{ij}, X_{ij}, OA_{ij}, IC_i, NO_{ij}\right) \quad (1)$$

where $TS_{ij}$ represents the level of satisfaction of a ski tourist i with ski resort j; $EA_{ij}$ is a vector of the natural attributes of skier i's experiences while traveling to ski resort j; $X_{ij}$ is the expenditure of skier i who pays for visiting ski resort j; and $OA_{ij}$ represents the attributes related to management and services at ski resort j experienced by the ski visitor i. $IC_i$ is a vector of personal traits of ski tourist i, and $NO_{ij}$ is a vector of non-observable factors of the ski tourist i who chose to visit the ski resort j. Now, the econometric model can be expressed in Eq. (2):

$$TS_{ij} = \alpha + \beta' EA_{ij} + \gamma' \ln(X_{ij}) + \delta' OA_{ij} + \varphi' IC_i + \varepsilon_{ij} \quad (2)$$

As no actual data related to $NO_{ij}$ were present, it can be omitted from the model expression. However, their relationships could be captured by the random error terms εij. In equation (2), $\alpha$ is a constant term, $\beta'$, $\gamma'$, $\delta'$, and $\varphi'$ are of the parameters to be estimated and each of them stands for the coefficient of attributes related to the natural environment, ski tourist expenditure, management and services, and tourist personal traits, respectively. Notably, each estimated parameter is the logarithmic value of the odds ratio of the base level of an attribute to an alternative level of the same attribute. For a given level of ski tourist satisfaction, the total differentiation of Eq. (1) was used to obtain Eq. (3) (in snapshot form):

$$d\mathrm{TS} = \frac{\gamma}{X_i} dX_i + \beta dEA_{ij} \quad (3)$$

When dTS =0, the marginal rate of substitution ($MRS_{cea}$) between the ski-tourist spending and an environmental attribute (ea) embedded in the ski resort can be expressed in Eq. (4):

$$MRS_{cea} = \frac{\partial X}{\partial EA} = \frac{\partial TS/\partial EA}{\partial TS/\partial X} = -\frac{\beta}{\gamma} \quad (4)$$

Eq. 4 was used to express how much a ski tourist's expenditure will change as a result of one-unit change of an environmental attribute when the level of ski tourist satisfaction remains constant. As we consider the logarithm of the ski-tourist spending variable in the estimation process, the marginal rate of substitution should be multiplied by the level of tourist spending to obtain the WTPi for the level of a change of environmental attribute [18]. Thus, Eq. (5) is expressed as follows:

$$WTP_i = MRS_{cea} * X_i = -\frac{\beta}{\gamma} * X_i \quad (5)$$

Eq. 5 expresses a ski-tourist's WTP for a change of environmental attribute level. This is called the economic value of the ski-resort attribute. As the dependent variable is categorical, the econometric

model can take the form of either an ordered probit (OP) or ordered logit (OL) model. However, empirical studies have shown that the ordinary least squares (OLS) model can generate results comparable with those of the OP or OL models [19]. Thus, the OLS model was also employed for the purpose of comparisons. The dependent variable is of ski tourists' subjective satisfaction, which is an ordinal variable with a self-reported five-level Likert scale ('1' = very dissatisfied, '2' = relatively dissatisfied, '3' = average, '4' = more satisfied, and '5'= most satisfied). The independent variables were selected based on a thorough literature review [9][19, 20]. In total, 15 attributes and nine demographic traits were chosen for the analysis (Table 1).

## 3. Model Results

### 3.1 Characterising Ski-resorts and Survey Respondents

As presented in Table 1, the mean satisfaction of ski tourists was 3.67, suggesting that overall ski tourists had an above-average level of satisfaction. On average, a ski tourist spent ￥360 per person-trip with minimum and maximum values of ￥38 and ￥4,997, respectively. This tourism expenditure included the money paid for admission tickets, driving, food, and beverages. On average, the size of a ski-resort was 76.3 hundred squared meters (hm2), ranging from a minimum of 4.6 hm2 to a maximum of 300 hm2.

Table 1. Descriptive statistics of the sampled data variables

| Variables | Type and Unit | Mean | Std.D | Min | Max |
|---|---|---|---|---|---|
| Satisfaction | Ordinal, (1-5) [a] | 3.67 | -- | 1 | 5 |
| Tourist spending | Numeric (￥) | 360.00 | 0.9688 | 38.00 | 4997.00 |
| Size the ski land area | $hm^2$ | 76.291 | 107.93 | 4.6 | 300 |
| Avg. length skiing runs | Numeric, meter | 789.55 | 524.63 | 237.5 | 2128.57 |
| Avg. slope skiing runs | Numeric, degree° | 13.13 | 5.99 | 6.43 | 27.13 |
| Snow machines | Numeric | 16.35 | 22.04 | 2 | 80 |
| Annual snowfall | Numeric, mm | 750 | 7.8463 | 5 | 1200 |
| Avg. daily temp. in ski season | Numeric, ℃ | -8.0130 | 7.9978 | -25 | -2.05 |
| Time waiting for next turn | Numeric, minutes | 15.023 | 3.106 | 5 | 30 |
| Quality of food service | Dummy, poor 0; good 1 | 0.622 | -- | 0 | 1 |
| Time waiting for parking | Numeric, minutes | 8.313 | 5.232 | 1 | 20 |
| Time waiting for a locker | Numeric, minutes | 10.12 | 3.758 | 1 | 22 |
| Convenience of bathroom | Dummy, inconvenient 0; convenient 1 | 0.5125 | -- | 1 | 5 |
| Gender | Dummy, female 1; male 0 | 0.4694 | -- | 0 | 1 |
| Age | Year | 29.51 | 3.9599 | 9 | 62 |
| Education level [b] | Ordinal, 1-6 | 3.4089 | -- | 1 | 6 |
| Monthly personal income | Numeric (￥) | 5100.66 | 3.1722 | 3500 | 18000 |

| | | | | | |
|---|---|---|---|---|---|
| Obs with Dep=1 | 567 | | | | |
| Obs with Dep=2 | 2,273 | | | | |
| Obs with Dep=3 | 2,582 | | | | |
| Obs with Dep=4 | 6,200 | | | | |
| Obs with Dep=5 | 3,875 | | | | |
| Total | 15,500 | | | | |

* Note: a: '1'= very dissatisfied (VD), '2'= relatively dissatisfied (RD), '3'= satisfied (S), '4'= quite satisfied (QS), and '5'= very satisfied (VS); b: '1'=primary school, '2'=junior high school, '3'=high school, '4'=junior college, '5'=undergraduate, '6'=master and above.

### 3.2 Importance of the Ski-resort Attributes to Skiing Tourists' Satisfaction

The results of OL model showed that the ski-tourist spending is negative and significant ($\alpha<0.01$). This implies that ski tourists who spent more money tend to have a lower level of satisfaction than those who spent less money. As a higher-spender tends to have a higher expectation from the ski travel, the gap between actual and expected perception will become wider, resulting in a negative relationship between the two factors, which is aligned with the law of demand in economics.

Table 2. Estimates of the ordered Logit, ordered Probit and OLS models

| Items | Ordered logit | Ordered probit | OLS |
|---|---|---|---|
| Ski-tourist spending (Ln) | -0.1732***<br>(0.0253) | -0.1583***<br>(0.0321) | -0.0804***<br>(0.0230) |
| Attributes of ski-resort | | | |
| Size of ski-resort land area | 0.0255***<br>(0.0022) | 0.0246***<br>(0.0012) | 0.0042***<br>(0.0005) |
| Avg. length of skiing runs | 0.0452***<br>(0.0041) | 0.0473***<br>(0.0031) | 0.0457***<br>(0.0031) |
| Avg. slope of skiing runs | 0.0324**<br>(0.0124) | 0.0297**<br>(0.0147) | 0.0335**<br>(0.0157) |
| Squared slope of skiing run | -0.3681***<br>(0.0101) | -0.3453***<br>(0.0109) | -0.0402***<br>(0.0124) |
| Avail. of snowmaking machines | 0.0189***<br>(0.0028) | 0.0172***<br>(0.0039) | 0.0159**<br>(0.0069) |
| Amount of annual snowfall | 0.0267**<br>(0.0126) | 0.0259**<br>(0.0129) | 0.0309***<br>(0.0101) |
| Avg. daily temp. in skiing season | 0.0256**<br>(0.0101) | 0.0209**<br>(0.0103) | 0.0283**<br>(0.0124) |
| Time waiting for the next skiing turn | -0.0225<br>(0.0179) | -0.0239<br>(0.0189) | -0.0132<br>(0.0121) |
| Quality of food services | 0.0235**<br>(0.0106) | 0.0247**<br>(0.0145) | --- |

| | | | |
|---|---|---|---|
| Time waiting for parking | 0.0028**<br>(0.0014) | 0.0031**<br>(0.0013) | 0.0041**<br>(0.0019) |
| Time waiting for a locker | -0.0165**<br>(0.0061) | -0.0152**<br>(0.0055) | -0.0069**<br>(0.0033) |
| Convenience of bathroom | 0.0106<br>(0.0161) | 0.0146<br>(0.0201) | --- |
| Personal traits | | | |
| Gender | -0.0614**<br>(0.0301) | -0.0512**<br>(0.0225) | -0.0647**<br>(0.0313) |
| Age | 0.4742<br>(0.2691) | 0.4249<br>(0.2291) | 0.2071<br>(0.1960) |
| Age squared | -0.0392**<br>(0.0193) | -0.0244**<br>(0.0120) | -0.0309**<br>(0.0150) |
| Educational degree (Reference: Master and above) | | | |
| Primary school | 0.3652<br>(0.3181) | 0.3473<br>(0.3351) | 0.3541<br>(0.4521) |
| Junior high | -0.0091<br>(0.2142) | -0.0094<br>(0.2564) | -0.0108<br>(0.2872) |
| Senior high | -0.1873<br>(0.1943) | -0.2085<br>(0.1983) | -0.02684<br>(0.2065) |
| Junior college | -0.0322<br>(0.1912) | -0.0402<br>(0.2013) | -0.0453<br>(0.3025) |
| Undergraduate | 0.0283<br>(0.1910) | 0.0302<br>(0.1849) | 0.0461<br>(0.2313) |
| Marital status | -0.2522<br>(0.5657) | -0.2716<br>(0.7105) | --- |
| Monthly personal income | -0.1141**<br>(0.0506) | -0.0569**<br>(0.0280) | -0.0289**<br>(0.0108) |
| Model performance | | | |
| $R^2$ | --- | --- | 0.495 |
| Pseudo $R^2$ | 0.4687 | 0.5014 | --- |
| Log likelihood | -1659.1247 | -1689.2513 | -1501.986 |
| Observations | 15,500 | 15,500 | 15,500 |

* Note: ** $p < 0.05$, and *** $p < 0.01$. Standard error of the estimate is presented in parentheses.

As presented in Table 2, most attributes of ski-resorts have a significant effect on the satisfaction of ski tourists at ($\alpha$=0.05 and 0.01). The sign of the ski-resort ground size is significantly positive ($\alpha$<0.01), implying that the level of satisfaction of ski tourists increases with an increasing ski-resort area. The average slope of the skiing runs is significantly positive ($\alpha$<0.01). This implies that on average, a ski tourist prefers to visit a facility with a diverse slopes to ensure that they could find the

ski slope to fit their level of skiing skills. However, the squared average slope of the runs is significantly negative. This implies that as the diversity of ski-run slopes increases, the level of satisfaction of ski tourists declines. This may be due to the fact that most ski visitors are at the beginner level. Snow machine has a significant positive ($\alpha<0.01$) effect on the ski tourists' satisfaction. The daily average temperature in the skiing season has a significant negative effect on ski visitors' satisfaction ($\alpha=0.05$). This suggests that the lower the temperature is capable to enhance ski visitors' satisfaction. As the temperature rises, the quality of ski runs will be degraded, thus decreasing the enjoyment of ski activities.

### 3.3 Effects of Demographic Traits on Skiing Tourism Satisfaction

As presented in Table 3, most demographic factors are not significant except for the gender, squared age, and monthly income. Gender has a significant positive effect on the satisfaction of ski tourists, suggesting that male ski visitors have a higher level of satisfaction than female ski visitors. Squared age imposes a significant negative effect on the satisfaction of ski visitors ($\alpha<0.05$), implying that to some extent, the satisfaction of visitors initially increases with the age rising but then declines. This could be attributed to the fact that skiing is a relatively risky sport; thus, it is more suitable for young people than for older people. Monthly personal income shows a significantly negative effect ($\alpha<0.05$), implying that a ski visitor with a high monthly income tends to have a relatively higher threshold of ski tourism satisfaction than one with a lower monthly income. In the other words, the ski tourism in China becomes an inferior good in economics terms.

### 3.4 Economic Values of Ski-Resort Attributes

The economic value of the ski resort attributes can be calculated using Eq. (5), and the estimated coefficients presented in Table 2. Table 3 presents the estimated value results for those focal ski-resort attributes when ski visitor's spending is set at ￥360 of the sample mean.

Table 3. Estimated economic values of the focal ski-resort attributes (￥)[τ]

| Variable | Ordered logit | Ordered probit |
|---|---|---|
| | WTP | WTP |
| Size of ski site/hm2 | 53.06 | 51.19 |
| Avg.length of ski runs/meter | 94.06 | 98.43 |
| Avg. slope of skiing runs | 46.61 | 39.95 |
| Daily temp. in the skiing season | 32.52 | 34.34 |
| No. of Snow machines | 39.33 | 31.61 |
| Distance from the nearest city center | 14.36 | 15.42 |
| Time waiting for parking | -5.24 | -6.26 |
| Time waiting for a locker room | -13.48 | 10.48 |
| Sum | 332.20 | 327.04 |

* Note:[τ] WTP is computed using Eq. (5), where $\beta$ and $\gamma$ are the estimated coefficients of attributes and ski-tourism spending, respectively, which are presented in Table 3. X denotes ski tourism expenditure.

The results of WTPs estimated using the two models differ slightly but are in accordance with those of previous studies [19][23] , suggesting that the estimated model results are robust. According to OL model, ski tourists are willing to pay ￥94.06 ($14.00) for the length of skiing

runs, which is the highest level of WTP among the focal ski-resort attributes, followed by the amount of annual snowfall, size of the ski area, average slope of skiing runs, and quality of food services, with each having WTP at ￥55.58 ($8.28), ￥53.06 ($7.90), ￥46.61 ($6.94), and ￥41.41 ($6.16) per person-trip, respectively. However, on average, a ski tourist’ s WTP for locating a parking space, and waiting time for a locker room are -￥5.24 (-$0.78), and -￥13.48 (-$2.01) per minute, respectively. This implies that a ski tourist must be paid the designated amount of money for them to perceive no difference between taking and forgoing the ski tourism travel. On average, a ski tourist’ s WTP is a total of ￥332.20 ($49.43) per person-trip.

## 4. Conclusion

In this study, we developed the ski tourism satisfaction (STS) method to value ski-resort attributes using the survey data of the Chinese ski tourists. Based on the reasonable model performances and the level of statistical significance achieved for those coefficient estimates, we can conclude that STS method could become a powerful tool for valuing ski resort attributes. The empirical results have the following implications for ski-resort management in China and across over the world. First, creating a good tourism ski resort is a huge undertaking. However, the most critical aspect is the reliability of natural snowfall. This may seem too obvious at first glance but it's often been overlooked in practice by decision makers. Second, ski resorts should be designed to meet the needs of most ski visitors, and not just those who are good at it. The lower ski-run slopes (< 10-15º) should be prioritized to better satisfy the mass ski tourists’ demand. Third, as the quality of food services is closely related to the ski tourists’ satisfaction, the management of ski resorts should pay more attention to this aspect. This could be done by either co-operating with food service companies or establishing self-sufficient restaurant facilities at the ski resorts. Fourth, as for managerial priorities, increasing the size of parking lots and adding more locker rooms are necessary for enhancing the ski tourists’ WTP, thus increasing the economic value of ski resorts.

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