Research on the Influencing Factors and Competitiveness of Chinese Provincial Skiing

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Abstract. Facing the new pattern of Chinese skiing industry, in order to analyze the skiing competitiveness of 20 key provinces, the index system was constructed. The index system was constructed for 10 variables from four dimensions: production factors, demand factorsperipheral support and enterprise competition. Through factor analysis, three main factors were extracted, including industry support, site core and ski demand conditions. Then score calculation and cluster analysis were carried out. The skiing competitiveness ranking and classification of these key provinces are obtained. On this basis, the feasibility suggestions for improving the competitiveness of skiing in our province are put forward to promote the further development of snow and ice sports.

1 Introduction

State Sport General Administration issued Development Plan of Snow Sports (2016-2025). The plan proposes that more than 50 million people will directly participate in snow sports, and 300 million people will participate in snow sports. Now is the preparation period for the 2022 Beijing Winter Olympics. In order to better achieve the planning objectives, it is necessary to study the current situation of residents' participation in skiing and the influencing factors.

Xiaolan Li analyzed the demand and resistance of ski industry transformation and upgrading under the background of Beijing 2022 Winter Olympic Games[1]. Haibo Ye pointed out that the hosting of the 2022 Winter Olympics will have a significant impact on the overall pattern of China's skiing tourism industry. With the increase of the number of ski resorts in North China, Northwest China, Southwest China and central and southern China, Northeast China will face certain competition[2]. Lu Wang constructed structural equation model to analyze the relationship between Heilongjiang ice snow tourism emotion and customer satisfaction[3]. Mona Mirehie pointed out that active participation in snow leisure activities can improve people's physical and mental health, especially among women. It is a positive psychological method to participate in ice and snow activities to obtain happiness[4]. Jennifer N. Whitehead discussed the factors influencing the participation of the youth of ethnic minorities in snow activities[5]. John C. Eun put forward some suggestions and opinions on how to avoid injuries caused by snow activities[6]. Tracey J.Dickson used descriptive statistics, chi square analysis, odds ratio and linear regression to analyze the trend of head injuries in snow activities at resorts in western Canada during the decade 2008-2018[7]. Young-JooAhnl discussed the organization and work arrangement of the Winter Olympic Games over the years[8].

At present, there is a large amount of data and more indicators in the research of domestic skiing industry. Factor analysis can use a few variables to reflect the main information of the original variables. Cluster analysis can group and classify a large number of data to understand the internal structure of the data set.

In this paper, the number of ski resorts is more than 10 as the sampling standard. Referring to the data in the 2018 White Paper on Skiing Industry, 20 provinces are selected as the research samples. From the four dimensions of production factors, demand factors, peripheral support and enterprise competition, 10 indicators are selected for factor analysis. On this basis, cluster analysis is carried out to find out the same competitiveness level provinces. On this basis, the feasibility suggestions for improving the competitiveness of skiing in our province are put forward to promote the further development of snow and ice sports.

2 Construct index system

On the basis of previous research findings[9-11], combined the data in the 2018 White Paper on Skiing Industry, 20 provinces were selected as the research samples. Taking the number of ski resorts more than 10 as the sampling standard. Based on the four first level indicators of production factors, demand factors, peripheral support and enterprise competition, 10 variables are selected as secondary indicators. Table 1 shows the index system of urban skiing competitiveness.

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Table1. index system of urb

Primary Indicators	Secondary Indicators
Production Factors	Number of Cableways X_1
	Number of Ski Resorts X_2
Peripheral Support	Traffic Convenience X_3
	Number of Accommodation Enterprises X_4
	Number of Catering Enterprises X_5
Enterprise Competition	Number of Ski Resorts with a Fall of more than 300 Meters X_6
	number of ski resorts with an area of more than 50 hectares X_7
Demand Factors	Per capita disposable income X_8
	GDP X_9
	Number of Higher Education Students per 100000 PopulationX_{10}

In order to ensure the timeliness, authority and scientificity of the data, the research data are mainly selected from China Statistical Yearbook and 2018 White Paper on Skiing Industry. The data in X_1, X_2, X_6, X_7 are from 2018 White Paper on Skiing Industry. The data in X_4, X_5, X_8, X_9, X_{10} are from China Statistical Yearbook. The data in X_3 are from the formula derivation. Transportation convenience=(railway mileage+highway mileage)/the total area of the region.

3 Analysis process

Using factor analysis to eliminate collinearity. Calculate the comprehensive score of 20 provinces skiing competitiveness and make a comprehensive ranking. Then, cluster analysis is carried out to find out the competitive regions at the same level among different provinces.

3.1 Factor analysis

According to the principle that the eigenvalue is greater than 1, the common factor is extracted. Calculation results are shown in Table 2. It can be seen from table 2 that the cumulative contribution rate of variance of the three factors is 79.783%, which basically covers most of the information of the original variable. So try to select three factors as common factors. The contribution rate of the first principal factor was 32.697%, the second principal factor was 32.242%, and the third principal factor was 14.844%.

Table2. Total Variance Explained

Factor	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	*% of Variance*	*Cumulative%*	*Total*	*% of Variance*	*Cumulative%*
1	4.667	46.670	46.670	3.270	32.697	32.697
2	1.945	19.447	66.116	3.224	32.242	64.939
3	1.367	13.667	79.783	1.484	14.844	79.783

In order to better name and explain the 3 extracted principal factors, the maximum variance method is used to rotate the factor load matrix. Table3 shows the rotated factor load matrix. The first main factor has a large load on the GDP, the number of catering enterprises, the number of accommodation enterprises and the traffic convenience. The first main factor mainly reflects the relevant information of the above variables. So the first main factor can be named "relevant industry support F_1". Relevant industry support explained 32.697% of the original variable information. The second main factor has a large load on the number of ski resorts with a fall of more than 300 meters, the number of cableways, the number of ski resorts with an area of more than 50 hectares, and the number of ski resorts. The second main factor mainly reflects the relevant information of the above variables. Therefore, the second principal factor can be named "site core F_2". Site core explained 32.242% of the original variable information. The third main factor has a large load on the number of students and per capita disposable income of higher education per 100000 population. The third main factor mainly reflects the relevant information of the above variables. Therefore, the third principal factor can be named "skiing demand condition F_3". The skiing demand condition explained 14.844% of the original variable information.

Table3. Rotated Component Matrix

Index	Factor		
	1	*2*	*3*
X_9	0.925	0.026	0.092
X_5	0.893	-0.306	0.094
X_4	0.889	-0.224	-0.052
X_3	0.690	-0.320	0.012
X_6	-0.266	0.901	0.013
X_1	-0.267	0.898	0.184
X_7	-0.074	0.867	-0.155
X_2	-0.143	0.739	0.049
X_{10}	0.167	-0.181	-0.894
X_8	0.391	-0.172	0.777

Determine the three main factors: relevant industry support F_1, site core F_2, skiing demand condition F_3. Combined with the data in Table 2, taking the proportion of variance contribution rate of each main factor in the total variance contribution rate of three main factors as the weight. The comprehensive score of skiing competitiveness of provinces is obtained:

$$F = (32.697 \times F_1 + 32.242 \times F_2 + 14.844 \times F_3) \div 79.783 \quad (1)$$

Table 4 shows the factor score, comprehensive score and ranking of provinces and cities are shown in.

Table4. Regional ranking and cluster analysis results

Province	F_1 Score	Rank	F_2 Score	Rank	F_3 Score	Rank	Comprehensive Score	Rank	Cluster Result
Hebei	0.56246	6	2.7963	1	-0.83431	17	1.21	1	1
Shandong	1.70774	2	0.2715	5	-0.12549	11	0.79	2	3
Jiangsu	1.90746	1	-0.206	10	0.354	8	0.76	3	3
Beijing	0.57409	5	-0.332	11	2.33304	1	0.54	4	2
Heilongjiang	-0.93495	17	1.7954	2	0.92703	4	0.51	5	1
Zhejiang	1.29841	3	-0.425	13	0.80813	5	0.51	6	3
Jilin	-0.74257	14	1.593	3	0.36149	7	0.41	7	1
Henan	1.11355	4	-0.161	9	-1.54029	19	0.1	8	3
Hubei	0.5584	7	-0.632	15	0.07464	9	-0.01	9	3
Shanxi	0.26722	9	-0.114	8	-0.62416	15	-0.05	10	3
Sichuan	0.49527	8	-0.509	14	-0.29761	13	-0.06	11	3
Liaoning	-0.68077	13	-0.085	7	0.96007	3	-0.13	12	2
Inner Mongolia	-1.10976	19	0.2683	6	0.72167	6	-0.21	13	2
Chongqing	0.10373	10	-0.761	17	-0.24731	12	-0.31	14	3
Xinjiang	-0.90207	16	0.4848	4	-1.28629	18	-0.41	15	3
Shanxi	-0.65292	12	-0.42	12	-0.02043	10	-0.44	16	3
Tianjin	-0.75893	15	-0.967	19	1.28073	2	-0.46	17	2
Guizhou	-0.29034	11	-0.823	18	-1.63636	20	-0.76	18	3
Gansu	-1.10289	18	-0.716	16	-0.52209	14	-0.84	19	3
Ningxia	-1.41313	20	-1.057	20	-0.68644	16	-1.13	20	3

3.2 Cluster analysis

On the basis of factor analysis, cluster analysis is carried out on the key provinces with the scores of relevant industry support, site core, skiing demand condition and comprehensive factor. The results are shown in Table 4. The average values of relevant industry support factor, site core factor and skiing demand condition factor of these three cities are calculated respectively. Table 5 shows the summary results.

Table5. Summary of categories

Ward Method	F_1 Score	F_2 Score	F_3 Score
First Kind Mean	-0.3716867	2.0615578	0.1514018
Second Kind Mean	0.9314725	-0.3171369	-0.1997618
Third Kind Mean	-0.7040800	-0.4052865	0.1270988
Total Mean	0.0000000	0.0000000	0.0000000

In the first category, Hebei, Jilin and Heilongjiang are the most competitive provinces. The first type of urban site core factor score is the highest. Jilin and Heilongjiang belong to the three eastern provinces of China, which are rich in ice and snow resources. Make it a province with strong skiing competitiveness. Although Hebei has no unique advantages in temperature and ice and snow resources, and the ability of skiing demand conditions and related industry supporting factors is relatively weak, its strong core elements of the field make its comprehensive competitiveness leap to the forefront of the country. Especially in recent years, with the opportunity of 2022 Beijing Olympic Games and regional advantages, it has attracted a large number of consumers from Beijing, Tianjin and surrounding areas.

In the second category, Beijing, Liaoning, Inner Mongolia and Tianjin are competitive in skiing. The second type of cities scored the highest in the related industry support factors. Liaoning and Inner Mongolia belong to the northern region of China, with unique geographical advantages and rich ice and snow resources. However, the core of the site is weaker than Heilongjiang and Jilin, which makes them belong to the second category. Tianjin and Beijing are close to Hebei and have strong skiing demand conditions. Since the Winter Olympic Games were held, a number of high-end large-scale ski resorts have been built in Hebei to provide support for the nearby areas.

The third category is Shandong, Jiangsu, Zhejiang, Henan, Hubei, Sichuan, Shaanxi, Chongqing, Xinjiang,

Shanxi, Guizhou, Gansu, Ningxia are weak competitive in skiing. There is a big gap with the first class provinces, and the market competitiveness is insufficient. These provinces are at a disadvantage in the core elements of the site, or do not have advantages in the supporting elements of related industries. Therefore, the comprehensive score of these provinces is not high. However, skiing demand in such areas has a strong momentum, which can promote the summer snow sports.

4 Conclusion

Taking 20 provinces as samples, this paper selects 10 indicators from four dimensions: production factors, demand factors, peripheral support and enterprise competition. Factor analysis obtains the comprehensive score ranking of skiing competitiveness of 20 provinces. Through cluster analysis, the same competitiveness level provinces are divided into three categories. The conclusions are as follows. First, Hebei ranks first in terms of comprehensive ranking, becoming the most competitive province. Second, as an old ski resort in China, Northeast China has obvious advantages in natural resources. However, the construction of ski brands and the allocation of related resources still need to be further improved. Third, the competitiveness of skiing in the central and western regions is weak and still has great development potential. We can carry out ice and snow activities according to local conditions, and strive to promote the summer snow activities.

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