

# Analysis on the Competitiveness of Guangdong Coastal Tourism Industry Based on Grey System Theory

Li Chao, Xiao Jianhua, Wu Feng

School of economics and management of Wuyi University  
Guangdong Jiangmen, 529020

**Abstract**—Aiming at the problem of the shortage of Guangdong coastal tourism industry's competitiveness, using grey system theory to analyse the grey correlation of influence factors, and then draw the conclusion of the grey correlation degree between various influence factors and coastal tourism revenues, furthermore put forward the promotion measures of the competitiveness of Guangdong coastal tourism industry.

**Keywords**—Grey system; Coastal tourism; Industrial competitiveness

## I. THE PRESENT SITUATION OF COASTAL TOURISM IN GUANGDONG PROVINCE

The coastal tourism industry is an important part of the development of the Marine economy, so the competitiveness of the coastal tourism industry has become the standard to measure the strength of the coastal tourism industry. Guangdong province is the big ocean province of China, and its third industry develops rapidly, which can provide impetus for the development of coastal tourism. In 2015, the GDP of Guangdong province was 7281.55 billion yuan, of which the first industry was 334.554 billion yuan, accounting for 4.5%, and the secondary industry was 3263.54 billion yuan, accounting for 44.8%, and the third industry was 365.347 billion yuan, accounting for 50.7%. It can be seen from the data that Guangdong province's overall economy is developing rapidly and the third industry has the largest proportion, which can provide the development impetus for the coastal tourism industry. In addition, the total tourism revenue of Guangdong province was 9080.76 billion yuan, accounting for 12.47% of the total GDP of the whole province, which was 33.68% higher than it in 2010. The tourism revenue accounts for 27.84% of the third industry, which was 40.05% higher than it in 2010. So we can see that, along with the changes to the third industry of industrial structure, at the same time of the rapid development of the third industry, tourism industry has been rapidly developed, and it gradually becomes the leading core industry which pulls the entire provincial economic development [1].

With the rapid development of tourism industry in the whole province, the tourism industry of 14 cities in the coastal area in Guangdong has achieved remarkable results. In 2015, the total tourism revenue of the whole province reached 9080.76 billion yuan, and the tourism revenue of 14 cities in the coastal area reached 7040.83 billion, accounting for 77.54% of the tourism

cities in Guangdong province. Among them, Guangzhou and Shenzhen account for the largest proportion and their tourism industry develops rapidly. In addition, the total tourism revenue of 14 cities in the coastal area of Guangdong province accounted for 11.04% of the total GDP of the 14coastal city, which was higher than the national average, and the coastal tourism industry develops rapidly. With the disordered development of coastal tourism, the development of coastal tourism in Guangdong province tends to homogenize with other coastal provinces is becoming more and more serious. Therefore, how to excavate the potential of coastal tourism in Guangdong province to shape the unique coastal tourism image, promote the competitiveness of the coastal tourism and stand out in coastal tourism spatial pattern in our whole country is particularly important [2].

## II. ANALYSIS OF THE COMPETITIVENESS OF COASTAL TOURISM INDUSTRY IN GUANGDONG PROVINCE

### A. Basic principles of grey theory

In 1982, Deng Jvlong founded the grey system theory, which can be used to study for the less of actual data and the problem of incomplete information. The object of the grey system theory study is lack of information. According to its known limited information, then remove the useless information, extracting useful information, and thus to infer and test if the system development behavior and evolution law is correctly or not [3]. Grey correlation analysis is the most commonly used analysis method in grey system theory. It is based on the known information in the system operation to understand the laws of system evolution, and forecasts the development trend of unknown information. It is essentially an analysis of correlation coefficient, according to the difference between the two factors in the system to determine the influence of factors on the system.

### B. Model of grey correlation analysis

According to the definition of grey correlation analysis, this paper is a reference sequence and several comparison sequences, so the following relation is used to indicate the difference between reference curve and comparison reference curve at various points.

$$\gamma(x_0(k), x_i(k)) = \frac{\min_k \min_i |x_0(k) - x_i(k)| + \xi \max_k \max_i |x_0(k) - x_i(k)|}{|x_0(k) - x_i(k)| + \xi \max_k \max_i |x_0(k) - x_i(k)|}, \xi \in (0,1)$$

$$\gamma(X_0, X_i) = \frac{1}{n} \sum_{k=1}^n \gamma(x_0(k), x_i(k))$$

Among them,  $\xi$  is called resolution coefficient,  $\xi$  usually takes 0.5,  $\gamma(X_0, X_i)$  is called the grey relational degree of  $X_0$  and  $X_i$ .

#### 1) Determine the analysis sequence

According to the Guangdong statistical yearbook, this article selects 14 coastal cities in Guangdong province from 2010 to 2015 of tourism revenue as the reference sequence. The number of practitioner in tour industry in Guangdong province in 2010, the number of domestic tourists, the number of inbound tourists, the number of tourism hotel and the per capita consumption level

of urban residents as comparison sequence. Specific data are shown in table 1.

From table 1, reference sequence:

= {3092.54, 4507.45, 5185.73, 6063.4, 7040.83}

Comparison sequence:

= {18141.96, 23911.55, 26753.13, 29405.8, 32779.82}

= {3141.09, 3500.65, 3397.88, 3355.45, 3445.36}

= {37841, 47260, 52418, 55853, 62779}

= {9179, 10733, 15368, 15926, 16440}

= {23159, 28269, 27531, 30216, 32393}

TABLE I. VARIABLY SELECTED IN GREY CORRELATION ANALYSIS

	2010	2012	2013	2014	2015
Tourism revenue of 14 coastal cities (billion yuan)	3092.54	4507.45	5185.73	6063.4	7040.83
the number of domestic tourists (000 person-time)	18141.96	23911.55	26753.13	29405.80	32779.82
the number of inbound tourists (000 person-time)	3141.09	3500.65	3397.88	3355.45	3445.36
the number of practitioner (person-time)	37841	47260	52418	55853	62779
the number of tourism hotel	9179	10733	15368	15926	16440
the per capita consumption level of urban residents(yuan)	23159	28269	27531	30216	32393

#### 2) Dimensionless processing of data

Because the original data dimension is different, the data error is large, so the original data needs to be treated with dimensionless treatment [4]. Usually, the dimensionless use the initial value method (we're going to take every number in the same sequence to divide by the first number). It can not only reflect the growth trend of the sequence sensitively, but also reflect the dynamic significance of the sequence.

Formula:

$$X_i' = \frac{X_i}{x_i(1)} = (x_i'(1), x_i'(2) \dots x_i'(n)), i = 0, 1, 2, \dots, 5$$

After the initial value process, we can see from table 2 that:

TABLE II. DATA INITIALIZATION TABLES

	2010	2012	2013	2014	2015
Tourism revenue of 14 coastal cities( $X_0$ )	1.0000	1.4575	1.6769	1.9606	2.2767
the number of domestic tourists( $X_1$ )	1.0000	1.3180	1.4746	1.6209	1.8069
the number of inbound tourists( $X_2$ )	1.0000	1.1145	1.0817	1.0682	1.0968
the number of practitioner( $X_3$ )	1.0000	1.2489	1.3852	1.4760	1.6590
the number of tourism hotel( $X_4$ )	1.0000	1.1693	1.6742	1.7350	1.7910
the per capita consumption level of urban residents( $X_5$ )	1.0000	1.2206	1.1887	1.3047	1.3987

### 3) The sequence of differential values

For initialization of data sequences, according to formula

$$\Delta_i(k) = \left| x_0'(k) - x_i'(k) \right|$$

Then calculate the absolute value of comparison sequence and reference sequence. The difference values of each sequence are shown in table 3

TABLE III. THE ABSOLUTE VALUE OF COMPARISON SEQUENCE AND REFERENCE SEQUENCE

	2010	2012	2013	2014	2015
the number of domestic tourists $\Delta_1(k)$	0	0.1395	0.2023	0.3397	0.4698
the number of inbound tourists $\Delta_2(k)$	0	0.3430	0.5952	0.8924	1.1799
the number of practitioner $\Delta_3(k)$	0	0.2086	0.2917	0.4846	0.6177
the number of tourism hotel $\Delta_4(k)$	0	0.2882	0.0027	0.2256	0.4857
the per capita consumption level of urban residents $\Delta_5(k)$	0	0.2369	0.4882	0.6559	0.8780

### 4) Take the maximum difference and minimum difference between the two levels

Maximum difference:

$$M = \max_i \max_k \Delta_i(k) = 1.1799$$

Minimum difference

$$m = \min_i \min_k \Delta_i(k) = 0$$

Solve the correlation coefficient

According to formula

$$\gamma_{oi}(k) = \frac{m + \xi M}{\Delta_i(k) + \xi M}, \xi \in (0,1), k = 0,1,\dots,5; i = 1,2,\dots,5$$

The solution results are shown in table 4.

TABLE IV. THE CORRELATION COEFFICIENT OF COASTAL TOURISM IN GUANGDONG PROVINCE

	2010	2012	2013	2014	2015
the number of domestic tourists $\gamma_{01}$	1.0000	0.8088	0.7447	0.6346	0.5567
the number of inbound tourists $\gamma_{02}$	1.0000	0.6323	0.4978	0.3980	0.3333
the number of practitioner $\gamma_{03}$	1.0000	0.7388	0.6691	0.5490	0.4885
the number of tourism hotel $\gamma_{04}$	1.0000	0.6718	0.9954	0.7234	0.5485
the per capita consumption level of urban residents $\gamma_{05}$	1.0000	0.7135	0.5472	0.4735	0.4019

### 5) Solve the gray relational degree

Because correlation is the average of correlation coefficient, the index of coastal tourism with the revenue of 14 coastal tourism cities grey correlation degree, according to the above

formula, we finally obtained the Guangdong coastal tourism industry's index's influence on the revenue of 14 coastal city. It is coastal tourism competitiveness, and it is shown in table 5.

TABLE V. GRAY CORRELATION DEGREE OF INFLUENCE FACTORS OF COASTAL TOURISM INDUSTRY IN GUANGDONG PROVINCE

the number of domestic tourists $\gamma_{01}$	0.7490
the number of inbound tourists $\gamma_{02}$	0.5723
the number of practitioner $\gamma_{03}$	0.6891
the number of tourism hotel $\gamma_{04}$	0.7348
the per capita consumption level of urban residents $\gamma_{05}$	0.5340

### III. ANALYSIS AND COUNTERMEASURES OF THE RESULTS OF COASTAL TOURISM INDUSTRY'S COMPETITIVENESS IN GUANGDONG PROVINCE

Through the above analysis process, the grey relational ranking can be obtained: the number of domestic tourists  $\gamma_{01}$  > the number of tourism hotel  $\gamma_{04}$  > the number of practitioner  $\gamma_{03}$  > the number of inbound tourists  $\gamma_{02}$  > the per capita consumption level of urban residents  $\gamma_{05}$

According to the results of grey relation, the following conclusions and countermeasures can be obtained.

(1) The grey relational of the number of domestic tourists in Guangdong province is the largest, which indicates that the tourism competitiveness of Guangdong province is closely related to the number of tourists who are attracted. If coastal tourism can attract more domestic tourists, the total revenue of coastal tourism will increase. Therefore, to develop the coastal tourism industry in Guangdong province, the key point is to attract more domestic tourists.

Countermeasures: In the face of domestic popular coastal holiday market, Guangdong need to attract more domestic tourists as a starting point. On the one hand, develop the coastal spa, coastal sports and coastal hotel products. And discover new hot spot of coastal tourism. On the other hand, strengthen the publicity of Guangdong coastal tourism, and raise its popularity. At last, we should pay attention to the different development strategies of the coastal cities, and accurately locate the characteristic coastal industries of coastal cities to attract more domestic tourists [5].

(2) The grey relational degree of the number of tourism hotel is located in the second place, and the number of hotels plays an important role in the promotion of tourism competitiveness in Guangdong province. Sufficient number of hotels can satisfy tourists' demand for accommodation and can attract more tourists.

Countermeasures: First, ensure sufficient number of hotels to meet the tourists' accommodation needs. Second, focus on the diversification of hotel types. Finally, pay attention to the management and supervision of the hotel to ensure the quality of hotel service and improve the satisfaction of tourists.

(3) The number of practitioner related to tourism ranks third, which has a great impact on coastal tourism competitiveness. Practitioners related to tourism are important human resources in developing the coastal tourism industry in Guangdong province. The number of practitioners directly affects the effect of the coastal tourism experience.

Countermeasures: First, increase the number of practitioner related to tourism and meet the human resource demand of the coastal industry. Second, strengthen vocational training for tourism practitioners and improve the professional ethics of the practitioners.

(4) The grey correlation of the number of inbound tourists ranked fourth, but it was closely related to the tourism revenue. Since ancient times, Guangdong is the earliest provinces of China maritime trade and immigration. With the further development of China's reform and opening up, Guangdong province, as one of the most famous overseas Chinese hometown, has attracted a large number of tourists who have the common history and culture and even overseas Chinese who are Chinese lineage and come from Hong Kong, Macao and Taiwan to come to travel.

Countermeasures: First, the theme of "overseas Chinese" is designed to enrich diversified tourism products and routes. Such as Jiangmen, with Kaiping diaolou and those views which have obvious characteristics of overseas Chinese hometown were put in the world cultural heritage list, we should carry out an in-depth study of the cultural tour of overseas Chinese with the theme of overseas Chinese. And we should focus on the development of the characteristics of Kaiping diaolou as a viewing point and the leisure sightseeing project of coastal experience. Secondly, when the development of the coastal tourism industry in Guangdong province is in the maintenance of the market of Hong Kong, Macao and Taiwan, we should increase the market development of customers in Europe and the United States and Oceania at the same time. Finally, according to the market segment, we should design coastal tourism products with Guangdong characteristics, and featured overseas Chinese township brands.

(5) The level of consumption of urban residents is relatively low in these five indicators, but its correlation degree is greater than 0.5, which indicates that it plays an important role in the promotion of coastal tourism competitiveness in Guangdong province. The consumption level represents the living standard of local citizens, and the improvement of consumption level represents the ability of urban residents to consume tourism products, thus providing a stable market of customers.

Countermeasures: On the one hand, Guangdong province should further promote the economic develop fast and well, and increase the income of residents. On the other hand, we should vigorously develop the coastal tourism industry and cultivate new consumption hotspots. Finally, we should expand consumption information channel and change people's consumption idea, then guide people's consumption on coastal tourism.

(6) Overall, all of grey correlation degree is greater than 0.5, which shows that these selected indicators are significant affecting Guangdong coastal tourism industry's competitiveness, and proves the rationality and scientific nature of the selected indicators.

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