An Empirical Analysis of the Model of the Coupled Coordination Degree of Tourism Economy Environment in Hunan Province

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Abstract—*The regional tourism economic environment is a complex system, which can provide a theoretical basis for the local government to study the coordinated development of regional tourism. Taking Hunan Province as an example, this paper selects the relevant statistical data from 2013 to 2000 to construct the Hunan tourism economic environment index system, thus to establish a comprehensive evaluation model and the coupled coordination model, and to analyze the relationship between tourism, economy and environment. Through empirical analysis, we find that the comprehensive score of the research is continuing to rise after 2003, and the coupling coordination degree reached 0.612 in 2007 and maintained a trend of increasing year by year. In 2013, it reached the level of quality coordination.*

Keywords— Tourism Economy Environment, Coupling Co Scheduling, Hunan Province

I. INTRODUCTION

Since the reform and opening up, the domestic tourism industry has got great development, and has become an important factor to promote the social and economic development. On the other hand, with the development of the times, people's living standards continue to improve, but the economic and tourism development will bring pollution to the environment. Therefore, how to coordinate the development of tourism, economy and environment has been a hot topic in the development of the region, and it is also a long-term problem faced by the scholars.

After 3 years of development, according to tourism, economy and environment can be divided into the following three categories, the first category is the study of economic and environmental coordination development: such as Wang Hui, Guo Lingling and Song Li [1] (2010) in Tibet Province, 2010 cities as an example, the economic and environmental coordination index system, Liaoning Province, 14 cities, for example, to calculate and analyze the economic and environmental coordination. The evaluation index and the normalized vegetation index, etc., have been distinguished in the coordinated development of economy and environment.

The second category is to study the coordination development between tourism and environment :Pang Wen, Ma Yaofeng and Yang Min [3] (2011) study of different types of urban tourism and environment coordination development level, Shanghai and Xi'an as an example to compare, the results found that the coordinated development of urban tourism and the environment generally exist mutual promotion and mutual restraint, Guo Xiaodong and Li Yingfei [4] (2014) using coordinated development model and dynamic evolution process, the level of coordination and development of Beijing City, Beijing city tourism development level and its dynamic evolution process. Coupling phase.

The third category is the research on the coordinated development of tourism and economy: Yu Jie [6] (2014) through the construction of tourism and economic coordination coupling coordinated development of 14 cities in Shandong Province, the research model, the results showed that Qingdao, Yantai, Ji'nan and other 8 cities to realize the coordinated development of tourism industry and regional economy, Tai'an, Rizhao City, 4 in a narrow coordination or imbalance, Dezhou, Liaocheng and other 5

cities have different degrees of imbalance; Zhan Xin Hui [7] (2013) in Henan Province as an example, through the coupling coordination model of inbound tourism and regional economic system, analysis of coupling relationship between tourism and economic system in Henan Province, the Henan provincial tourism with the economic system coordination degree to enhance the stability, economic effects of tourism development lags behind the tourism effect on economic development.

Sub system	First level indicator	Second level indicator
Tourism system	income level	domestic tourism income
		Earn foreign exchange income
	Economic structure	The total number of industrial tourism reception
		Star Hotel number
Economic system	Economic level	GDP
		Per capita GDP
	Economic structure	Second industry specific gravity
		Third industry specific gravity
Environmental system	Ecological environment	the built-up area green coverage rate
		Per capita park green area
	Solid waste environment	The rate ofof industrial solid waste
		Living garbage harmless treatment rate of

Fig 1. Hunan Province, tourism, economy and environment index system

Comprehensive literature, mostly based on the 2 systems of tourism, economy and environment in the 3 systems to coordinate the development of research, and analysis of the 3 systems to coordinate the development of the literature is less. Because of the different regional development level, the tourism, economy and environment are mutually promote and restrict each other. For any one of the three, it is bound to have a bias and error [8]. In the existing research results, the selection of the region is not typical, and the selection of indicators has a certain random [9]; however, it is only based on the coordination of tourism economy and economic environment two two. Therefore, this paper takes Hunan Province as an example, combined with the existing research results to select a representative index to build Hunan province tourism economic environment coupled model.

II. HUNAN TOURISM ECONOMIC ENVIRONMENT COUPLED MODEL

2.1 Data sources and index system establishment

Tourism economy environment is a complex system, which is a complex system. This paper is based on the combination of total and average index, proportion, data reliability and availability, etc., and the relevant data were collected and sorted in 2013 to 2000 in Hunan province.

2.2 The establishment of the model of the coupling coordinated development

2.2.1Non dimensional treatment of data

Since the measurement units of the various indicators are different, the index is not comparable, so the data are non - dimensional treatment before the establishment of the coupling coordination model. In this paper, a multiple transformation method is adopted, which is composed of the initial data matrix.

$$X = \begin{pmatrix} x_{11} \cdots x_{1n} \\ \cdots \quad \cdots \\ x_{m1} \quad x_{mn} \end{pmatrix}_{m \times n}$$

Get the standardized data matrix $x'_{ij} = x_j / x_{\min}$. Among them, the value of the evaluation index of the first j of the I sample is indicated, 0<i<m，0<j<n。

2.2.2Index weight of each subsystem

In this paper, using the entropy weight method to calculate the index weight of each subsystem. Entropy weighting method, the optimal weight is calculated according to the actual data of each sample, in a certain extent, to avoid the

deviation caused by human factors, to reflect the index information entropy of information utility. The basic calculation steps are as follows:

（1）Data standardization processing, by 2.2.1 Available x'_{ij} Is the standard data matrix；

（2）The weight matrix of the data is calculated by $y_{ij} = x'_{ij} / \sum_{i=1}^{m} x'_{ij} (0 < y_{ij} < 1)$, which indicates that the proportion of the i y_{ij} value of the first I sample is expressed in terms of the j index;

（3）To calculate the index information entropy, can be calculated by $e_j = -K \sum_{i=1}^{m} y_{ij} \ln y_{ij}$, which e_j represents the j indicators of information entropy, K is constant ,K=1/ln(m)；

（4）The utility value of the information is calculated by $d_j = 1 - e_j$, which d_j represents the information utility value of the j index, which is used to reflect the weight;

（5）The weight of the evaluation index is calculated by $w_j = d_j / \sum_{i=1}^{m} d_j$, which w_j represents the weight of the index of J.

2.2.3Comprehensive evaluation function of the coupled system

The study on the coordinated development of tourism economy environment in Guangdong Province, which is used by Zhong Xia and other [9], indicates that the comprehensive evaluation function of the tourism, the economy and the environment is as follows (2) (3) (1):

$$U1 = \sum_{i=1}^{h} a_i x'_i \qquad (1)$$

$$U2 = \sum_{i=1}^{k} b_i y'_i \qquad (2)$$

$$U3 = \sum_{i=1}^{l} c_i z'_i \qquad (3)$$

The characteristic values of the non dimensional (by 2.2.1) x'_i、y'_i、z'_i represent of the tourism, the economy and the environment , a_i、b_i、c_i are respectively represented by the index weight of the tourism, economy and environment (by 2.2.2).

Therefore, the comprehensive evaluation function of the coupled system $T = \alpha U1 + \beta U2 + \gamma U3$, α、β、γ are the undetermined coefficient of each corresponding evaluation function.

2.2.4 Tourism economic environment coupling co scheduling

Coupling degree is a measure of the interaction between two or more than two systems or the interaction between the elements, the capacity of the coupling coefficient model derived from the physics, this paper studies the relationship between the 3 systems of tourism, economy and environment, then the coupling coefficient model:

$$C = \{ \frac{U1 \times U2 \times U3}{[\frac{U1 + U2 + U3}{3}]^3} \}^{\frac{1}{3}}$$

The C indicates that the coupling coefficient of the tourism economy environment, $0 \le C \le 1$,and the larger the C is, the more the system has a better interaction.

In order to better reflect the level of coordinated development between systems, in addition to the computing system coupling givers need according to a coupled system of comprehensive evaluation function (2.2.3), the formula for calculating the coupling coordination scheduling are as follows:

$$D = \sqrt{C \times T}$$

Where D indicates that the coupling is scheduled, the numerical value can be divided into the following levels (see Table 1).

Table 1 evaluation criteria of coupling coordination degree

Serial number	Coordination degree	Coordination level	Serial number	Coordination degree	Coordination level
1	0-0.09	extreme imbalance	6	0.50-0.59	barely offset
2	0.01-0.19	Serious imbalance	7	0.60-0.69	primary disorders
3	0.20-0.29	moderate imbalance	8	0.70-0.79	intermediate
4	0.30-0.39	mild imbalance	9	0.80-0.89	good coordination
5	0.40-0.49	Approach imbalance	10	0.90-1.00	quality coordination

Source: Liao Zhongbin. Quantitative evaluation and classification system of the coordinated development of environment and economy [J].Tropical geography, 1999, (2): 171~177

III. AN EMPIRICAL ANALYSIS OF THE HUNAN TOURISM ECONOMIC ENVIRONMENT COUPLING DEVELOPMENT

First of all, according to the above research methods to solve the model, the relevant data collected and sorted by 2.1, m=14, n=12. After getting the standard data matrix, calculate the weight of each sub system, the results are shown in Table 2.

Table 2 the weight of the index coefficient of Hunan tourism economy environment

Sub system	First level indicator	Second level indicator	weight
Tourism system	income level	domestic tourism income	0.4419
		Earn foreign exchange income	0.2070
	Economic structure	The total number of industrial tourism reception	0.2972
		Star Hotel number	0.0539
Economic system	Economic level	GDP	0.5103
		Per capita GDP	0.4760
	Economic structure	Second industry specific gravity	0.0119
		Third industry specific gravity	0.0018
Environmental system	Ecological environment	the built-up area green coverage rate	0.0817
		Per capita park green area	0.2430
	Solid waste environment	The rate ofof industrial solid waste	0.0746
		Living garbage harmless treatment rate of	0.6007

Second,through $\alpha = \beta = \gamma = \frac{1}{3}$ we obtain the comprehensive evaluation function (U1, U2.U3, T), coupling coefficient (C) and (D), and the results are shown in Figure 2 and Figure 3

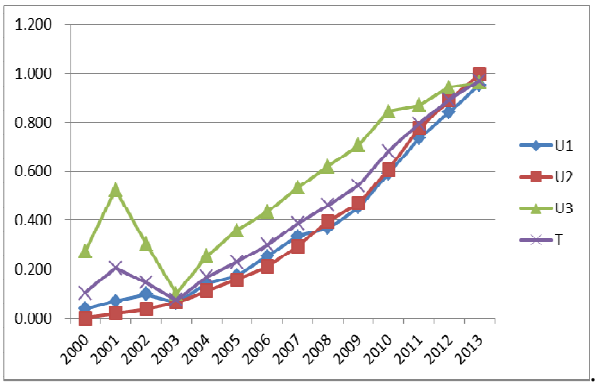

Fig. 2. 2000. The integrated evaluation function of the tourism economy environment system in the year to 2013

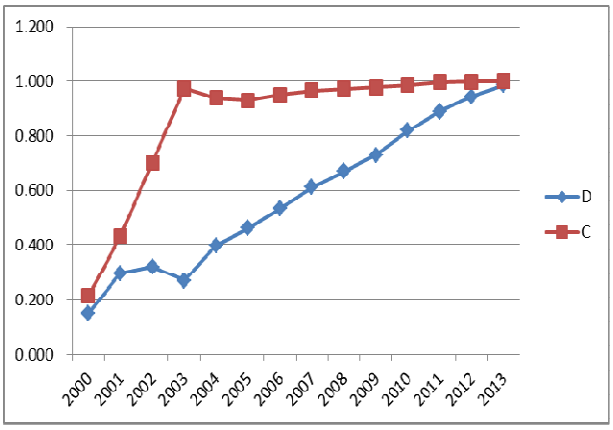

Fig. 3. 2000 years from 2013 to the tourism economy – environment coupling coefficient and coupling coordination degree line chart

From Figure 2 it can be seen that the comprehensive score of the tourism economic environment system in 2000 to 2013 has increased year by year. The comprehensive score of the coupled system in 2013 reached 0.972. The comprehensive score of the tourism and economic system maintained a similar trend. The comprehensive score of the environmental system decreased from 0.525 to 0.099, and its comprehensive score decreased sharply. Overall, the overall score of the environmental system in the tourism and economic system, but in 2013 the overall score of the environmental system is slightly lower and the overall score of the economic system, which shows that with the development of the times and the improvement of the relevant policies, tourism and economic impact on the environment is still not negligible.

As can be seen from Figure 3, although early on and after 2003, the tourism economy environment coupling coefficient reached a high level, but its coordinated development still maintain a steady upward trend, from the process of serious imbalance gradually turned to high quality coordinated time is needed, and this difference is due to the development of various regions of Hunan caused by the different it was also quoted, coupling coordination degree evaluation of the failure reasons to avoid coordination; the coupling degree is 0.612 in 2007, the coordinated development of Hunan tourism, economy and environment began to enter into the running stage, reach a benign development period, which may be related to the ninth Hunan provincial Party Congress (2007) tourism defined as the pillar industry, in 2013 the coupling degree of 0.986, to achieve the high quality coordination level, indicating that the government policies in place, should continue to maintain.

IV. CONCLUSIONS AND RECOMMENDATIONS

This paper is to expand the theoretical research on the coordinated development of the regional tourism, economy and environment, and the dynamic comparison of regional horizontal and vertical is not deep. Based on the existing data, the coupled coordination model is applied to the study of regional tourism economy environment system, and the relationship between the three can be obtained. Through the empirical analysis, the comprehensive score of Hunan province is increasing year by year, and the coordinated development of the line chart is similar to that in 2013.

Hunan province related industry development so far, its tourism, economic and environmental coordination to achieve quality level and related government departments of policy guidance, the proposed Hunan province should continue to maintain economic growth and the development of tourism industry, but can not be the cost of environmental protection, strengthen environmental protection consciousness, appropriate adjustment of the

structure of the relevant industry, and then promote the development of Hunan.

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REFERENCE

[1] Guo Lingling, Wang Hui, Song Li. Quantitative research on the economic and environmental coordination degree of the 14 cities of Liaoning Province, [J].

[2] Yang Zhiyong, Lv Jun. The comprehensive evaluation of the development of tourism, eco - economic system in Inner Mongolia [J]. Journal of Beijing International Studies University, 2010,03:73-78+57.

[3] Zhang Yili, Wang Zhaofeng, Sun Wei, Zhao Dongsheng, Liu Linshan. Analysis method of county economy and environment coordinated development -- Taking Tibet autonomous region as an example of [J]. 2010,07:797-802.

[4] Liu Dinghui, Yang Yongchun. Study on the regional economy, tourism and ecological environment coupling. The resources and environment of the Yangtze River Basin in Anhui Province, province, 2011,07:892-896.

[5] Pang Wen, Ma Yaofeng, Tang Zhongxia. Study on the coupling relationship between tourism economy and ecological environment and the coordinated development of Xi'an city as an example [J]. Journal of Northwestern University (NATURAL SCIENCE EDITION), 2011,06:1097-1101+1106.

[6] Yu Jie, Shandong provincial tourism industry and regional economic coordination degree evaluation and optimization of [J]. Chinese population. Resources and environment, 2014,04:163-168.

[7] Wang Liangqiu, Li Wenhui, Yu Guanghui, Ceng Qunhua, Deng Mingjun,,, Hunan Province, economic and environmental coordination and its evaluation of [J]. land and natural resources research, 2014,01:10-13.

[8] Xiao Xiaoying. The coordination of tourism economy and ecological environment based on the coupled model [J]. commercial era, 2014,06:138-140.

[9] Guo Xiaodong, Li Yingfei. Research on the coordination development of urban tourism economy and ecological environment -- Taking Beijing as an example of [J]. development and research, 2014,02:78-81.

[10] Zhan Xinhui, Ma Yaofeng, Liu Junsheng. The coupling of inbound tourism flow and regional economic development coordination degree study -- Taking Henan Province for example [J]. Henan science and 2013,06:913-919.

[11] Zhong Xia, Liu Yihua, Guangdong Province, province, tourism, economic and ecological environment, coupled with the coordinated development of tropical geography, 2012,05:568-574.

[12] Students delay, zhongzhiping. The coupling of the tourism industry and regional economic coordination degree study in Hunan Province for example [J]. Tourism Tribune, 2009,08:23-29.

[13] Liao Zhongbin. Quantitative evaluation and classification system of environmental and economic coordination development -- Taking Pearl River Delta as an example of [J]. tropical geography, 1999,02:76-82.

[14] Yang Zhiyong, Lv Jun. The comprehensive evaluation of the development of tourism, eco - economic system in Inner Mongolia [J]. Journal of Beijing International Studies University, 2010,03:73-78+57.