

Study on Coupling coordination degree between tourism industry and regional economy in Yangtze River Economic Belt

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Abstract. Taking 11 provinces and cities along the Yangtze River economic belt as the research object, based on the panel data of tourism industry and regional economy in the region from 2010 to 2019, the coupled coordination degree model was used to analyze the development status of tourism industry, regional economy and their coordination degree in the region. The results show that the regional economy, tourism industry and coupling coordination degree of the Yangtze River Economic Belt are on the rise, but the coupling coordination degree is still at a low level. Jiangsu Province, which has the highest coupling coordination degree, is only in the primary coordination stage, and there is still a large space for development. During the study period, economic differences between regions increased and tourism industry level differences narrowed. Jiangsu Province had the fastest growth rate of regional economy, while Yunnan Province had the fastest growth rate of tourism industry. In addition, from the overall point of view of "1+1>2", suggestions are put forward to promote the coordinated development of tourism industry and regional economy in this region.

Keywords: Yangtze River Economic Belt; Entropy method; Coupling coordination model

1. INTRODUCTION

The tourism industry has become the strategic pillar industry of Chinese national economy because of the variety of industries involved and the wide range of radiation. The development of regional economy will also react on the tourism industry through the improvement of infrastructure, accessibility of transportation, increase of resident income and other aspects. Tourism industry and regional economy interact and influence each other.

For the correlation between tourism industry and regional economy, scholars at home and abroad have had very fruitful research results. In terms of research objects, literature^{[10][8,10]}analyzed the coupling relationship between tourism industry and regional economy of a single object in China and Sichuan Province respectively through numerous indicators, and concluded that the growth of tourism industry and regional economy would promote the improvement of coordination degree. According to the changes of coupling coordination degree, the coupling coordination change process of China's tourism industry and regional economy was divided into three stages. Lulu Wang^[5]took 11 cities in Zhejiang Province as the research unit to analyze the coupling time change trend of tourism industry and regional economy. Based on the panel data of 9 cities in the Pearl River Delta, Yu Jie^[9]discussed

the degree of coupling and coordination from the perspectives of time and space. In terms of research methods, Wang Zhaofeng^[6] used the locational entropy formula and the Douglas production function model to study the influence degree of tourism industry agglomeration on regional growth in Wuling District, Hunan Province. Jing Xiuli^[3] built a system dynamics model of Shenzhen's tourism industry and regional economic development from the perspective of system dynamics, and conducted simulation experiments. Research content Gan Chang^[1] used linear weighting method and coupled coordination model to study the coupling relationship between tourism development and economic resilience in Hunan Province and the spatial-temporal distribution pattern. Yang Jinbo^[7] took Guizhou Province as a research area, studied the relationship between tourism income and gross national product, analyzed the contribution of tourism industry to regional economy, and put forward relevant suggestions on tourism development in Guizhou Province.

At present, there are many domestic researches on the relationship between regional economy and tourism industry, most of which take one province as the research object. However, there are few researches on the coupling development between tourism industry and regional economy in a region with a large gap in development level. In view of this, based on the 11 provinces and cities of the Yangtze River Economic Belt from 2010 to 2019 as the research object, this paper constructs the index system of the regional economy and tourism industry system, normalizes the index by entropy method, and evaluates the development level of the regional economy and tourism industry by coupling coordination degree model, which provides suggestions for promoting the coordinated development of tourism industry and regional economy of provinces and cities in the Yangtze River Economic Belt.

2. RESEARCH AREA, INDEX SYSTEM AND METHOD

2.1 Overview of the study area

The Yangtze River Economic Belt, with Shanghai, Wuhan and Chongqing as the core and Shanghai-Shanghai and Shanghai-Chengdu transportation corridors as the basis for development, forms the Yangtze River Delta City cluster, the middle reaches of the Yangtze River City cluster and the Chengdu-Chongqing city cluster, covering 11 provinces and cities including Yunnan, Sichuan, Chongqing, Guizhou and Hunan, accounting for 21.4% of the total area of China. Its population and GDP account for about 40% of China's total. The Yangtze River Economic Belt is rich in tourism resources and attracts a large number of tourists. In 2017, the total number of tourists in the Yangtze River Economic Belt accounted for 46.50% of the total number of tourists in China, and the total revenue of tourism accounted for 44.21% of the total revenue of tourism in China. Therefore, accelerating the development of tourism is a bright spot for the region's economic growth in the future. To sum up, it is of great significance to analyze and study the coupling between tourism industry and regional economy in this region to promote the development of tourism industry and regional economy.

2.2 Index system

2.2.1 Establishment of index system

Based on the principles of comprehensiveness, representativeness and availability of selected indicators, this paper draws on the index system proposed by Gao Nan^[2] and Liang Yongxian^[4] to construct the coupled and coordinated evaluation index system of tourism industry and regional economy of the Yangtze River Economic Belt, in which 8 indicators are adopted by the regional economic system and 7 indicators by the tourism industry system (as shown in Table 1).

2.2.2 Data Sources

This paper selects 11 provinces and cities in the Yangtze River Economic Belt, including Shanghai, Jiangsu, Zhejiang, Hunan, Hubei, Jiangxi, Anhui, Yunnan, Sichuan, Chongqing and Guizhou. The period from 2010 to 2019 was selected as the research time. The data came from the statistical yearbooks and statistical communiques of the 11 provinces and cities.

Table 1: Evaluation index system of tourism industry and regional economic development in the Yangtze River Economic Belt

System layer	indicator layer	unit	weight
Regional economic system	Gross domestic product	billion yuan	0.1407
	The tertiary industry	billion yuan	0.1645
	The fiscal expenditure	million yuan	0.0978
	The fiscal revenue	billion yuan	0.1502
	Fixed assets	billion yuan	0.1338
	The consumption level of residents	yuan	0.0677
	The consumption level of villagers	yuan	0.1211
Tourism industry system	The number of passengers	Ten thousand people	0.1243
	The number of inbound tourists	Ten thousand people	0.1616
	The number of domestic tourists	Ten thousand people	0.0971
	Foreign exchange income from tourism	Billions of dollars	0.1993
	Domestic tourism revenue	billion yuan	0.1503
	The total tourism revenue	million yuan	0.1451
	Above the limit of accommodation and catering enterprises	several	0.0882
The turnover of accommodation and catering industry above the quota	billion yuan	0.1585	

2.3 Research Methods

2.3.1 Entropy method

In this paper, entropy method is used to calculate the proportion of various indicators in regional economy and tourism industry, and then calculate the comprehensive development level of regional economy and tourism industry.

2.3.2 Coupling coordination degree model

The coupling coordination degree model originally originated from physics, which is mainly used to evaluate the coordination status among multiple systems. This paper draws on the studies of other scholars to discuss the coupling coordination type between the tourism industry and regional economy in the Yangtze River Economic Belt. The specific calculation formula is as follows:

$$C = \sqrt{\frac{u_1 \times u_2}{(u_1 + u_2) \times (u_1 + u_2)}} \quad (1)$$

$$D = \sqrt{C \times T} \quad (2)$$

$$T = \alpha u_1 + \beta u_2 \quad (3)$$

Where, C is the coupling degree value, D is the coupling coordination degree, and T is the composite index. u_1 is the comprehensive evaluation value of regional economic system, u_2 is the comprehensive evaluation value of tourism industry system. Alpha and beta are undetermined coefficients, and by convention, they are usually 0.5. D represents the degree of coordination between systems, and the value is [0,1]. The closer it is to 1, the stronger the condition of coupling degree coordination between systems, and the closer it is to 0, the weaker the degree of coupling degree coordination between systems. The closer the value of C is to 1, the higher the interaction between systems is. When $u_1 > u_2$, it indicates that the regional economic composite index is greater than the tourism industry composite index, and the tourism industry lags behind the regional economy. When $u_1 < u_2$, it indicates that the tourism industry composite index is greater than the regional economic composite index, and the regional economy lags behind the development of the tourism industry. When $u_1 = u_2$, it indicates that the tourism industry composite index is equal to the regional economic composite index, and both develop synchronously.

3. SPATIAL AND TEMPORAL DISTRIBUTION OF COUPLING COORDINATION DEGREE BETWEEN TOURISM INDUSTRY AND REGIONAL ECONOMY IN THE YANGTZE RIVER ECONOMIC BELT

3.1 Development level of tourism industry

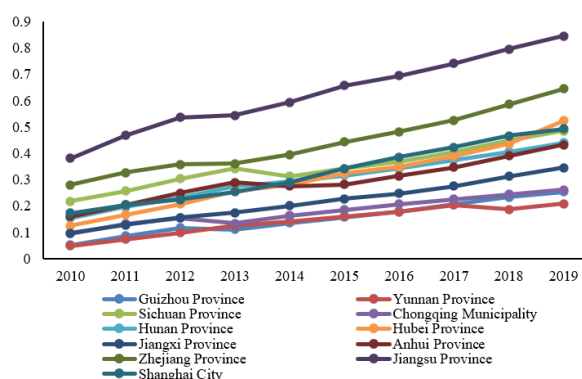


Figure 1: Tourism industry development level of provinces and cities in the Yangtze River Economic Belt

According to the entropy method, the development level index of provinces and cities in the Yangtze River Economic Belt from 2010 to 2019 was calculated (as shown in Figure 1). In 2010, the comprehensive tourism development index of all provinces and cities in the Yangtze River Economic Belt showed a rising region on the whole. Among them, the comprehensive tourism development index of Yunnan Province has the fastest growth, from 0.12 in 2010 to 0.62 in 2019, with an increase of 0.4 units. The overall comprehensive development level of tourism in Zhejiang Province, Jiangsu Province and Shanghai from 2010 to 2019 is higher than that of other regions. The comprehensive development index of tourism economy in Jiangsu Province declined in 2013. Through checking the data, it is found that the number of inbound tourists in Jiangsu Province decreased from 7.92 million to 2.88 million in 2013. The main reasons are environmental quality and food safety problems such as haze weather, and the continuous tension between China and Japan. At the same time, the impression of Jiangsu tourism products to foreign tourists is mainly Suzhou gardens, with a single product. The comprehensive development index of tourism in Zhejiang Province fell back in 2018, mainly due to the adjustment of the statistical standard of inbound tourism in Zhejiang Province from 2018, the change of international situation, the appreciation of RMB and the decline of the competitive advantage of tourism products. The tourism comprehensive index of Sichuan Province, Anhui Province, Hunan Province, Guizhou Province and Hubei Province is in the middle level of development. Besides Yunnan Province, Sichuan Province and Guizhou province are the provinces with fast growth of tourism comprehensive index. The comprehensive development index of tourism in Chongqing and Jiangxi Province grew slowly and their development level was lower than that of other provinces and cities.

3.2 Analysis of regional economic development level

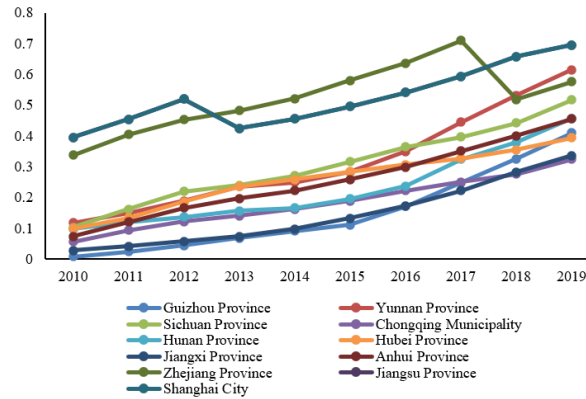


Figure 2 Comprehensive development level of regional economy of provinces and cities in the Yangtze River Economic Belt

The comprehensive economic development index of provinces and cities in the Yangtze River Economic Belt is calculated according to the entropy method, and the results are shown in Figure 2. From 2010 to 2019, the comprehensive economic development index of provinces and cities showed a trend of year by year growth, among which Jiangsu Province's comprehensive economic development index far exceeded other provinces and cities, followed by Zhejiang Province. The comprehensive economic development index of Shanghai has the fastest growth rate. Since the area of Shanghai is much smaller than that of other provinces and the resources it can gather are limited, its comprehensive economic development index is smaller than that of Jiangsu, Zhejiang and Hubei provinces. However, the geographical location of Shanghai and the support of the government have promoted the rapid development of the regional economy of Shanghai. The comprehensive economic development level of Hubei Province, Sichuan Province, Hunan Province and Anhui Province is in the middle position. Among the four provinces, Hubei province developed the fastest, from 0.13 in 2010 to more than 0.53 in 2019, with an increase of 0.4 economic growth index. The comprehensive economic development index of Sichuan Province and Anhui Province fell back in 2014. After checking the data, it is found that the passenger flow has plummeted. The main reason may be the rise of high-speed rail and the number of private cars. People are more willing to take faster and more comfortable means of transportation. The comprehensive economic development index of Jiangxi Province, Yunnan Province, Chongqing City and Guizhou Province was lower, and the development level of Jiangxi Province was higher than that of the other three regions. The growth rate of the comprehensive economic growth index of Yunnan province was slower, from 0.05 in 2010 to 0.21 in 2019.

According to Figure 1 and Figure 2, it can be found that the comprehensive economic index of Jiangsu Province and Hubei Province is greater than the comprehensive development index of tourism, and the regional economic development speed is faster than the tourism industry. In view of this phenomenon, Jiangsu Province and Hubei province can adjust and integrate regional tourism resources. Tourism products work hard in culture to improve the connotation of tourism products; Strengthen communication and cooperation among relevant departments

to jointly solve problems in various fields; Through campus cooperation and government support, it aims to cultivate multilingual talents. The comprehensive development index of tourism in Yunnan Province and Guizhou Province is higher than the comprehensive development index of economy, indicating that the regional economy lags far behind the tourism industry. Therefore, Yunnan Province and Guizhou Province should continue to vigorously develop the tourism industry, so that the tourism industry can drive the development of other industries. The comprehensive development index of regional economy and tourism in Zhejiang Province is relatively balanced, but the tourism development index was 0.71 in 2017, decreased to 0.52 in 2018, and picked up in 2019, mainly because of the decrease of foreign tourists. The overall development level of regional economy and tourism industry in Jiangxi Province is low. The main reasons may be as follows: except the plain of Poyang Lake, most of the landforms in Jiangxi Province are mountainous and hilly, and the transportation is inconvenient; The industrial structure is dominated by agriculture and the economic chain is short. Backward education and serious brain drain.

3.3 Analysis of coupling coordination degree

Based on the coupling coordination degree model, the coupling coordination degree of tourism industry and regional economy of provinces and cities in the Yangtze River Economic Belt from 2010 to 2019 was calculated. The results showed that by 2019, the coupling coordination degree of tourism industry and regional economy in the Yangtze River Economic Belt was still at a low level, among which, Jiangsu Province was the highest but only in the primary coordination state. During the study period, the coupling coordination degree of provinces and cities in the Yangtze River Economic Belt showed a trend of fluctuation rising, and the fastest rising regions were Guizhou Province and Jiangxi Province, with an increase rate of 74% and 60%.

In 2010, the highest coupling coordination degree was 0.441 in Jiangsu Province, which was on the verge of imbalance. The coupling coordination degree of Zhejiang Province and Shanghai City was 0.393 and 0.365, respectively, which belonged to mild disorder. Guizhou Province, Jiangxi Province, Chongqing City and Yunnan Province had a low coupling coordination degree between 0.1 and 0.2, which was a moderate imbalance. In the rest of Hunan, Hubei, Anhui and Sichuan provinces, the coupling coordination degree between 0.2 and 0.3 was mildly disordered.

In 2015, the coupling coordination degree of Jiangsu Province and Zhejiang Province was greater than 0.5, which were 0.535 and 0.504 respectively, and the coupling coordination degree was improved from the verge of imbalance to barely coordination. Shanghai and Sichuan Province are barely in harmony, with Sichuan province growing faster, from 0.275 in 2010 to 0.406 in 2019. Yunnan, Hunan, Hubei, Anhui and Chongqing are on the verge of imbalance. Guizhou and Jiangxi provinces, though moderately dysfunctional, saw the fastest growth rates of 60 percent and 45 percent, respectively, from 2010 to 2015.

In 2019, the coupling coordination degree of Jiangsu Province was 0.619, the highest coupling coordination degree, and it was in the primary coordination. The coupling coordination degree of Zhejiang Province, Shanghai City and Sichuan Province is between 0.5 and 0.6, which is barely coordinated. Sichuan Province is the province with the fastest growth rate of 19% among the three provinces and cities, Chongqing is mildly disordered, and other provinces and cities are on the verge of disordered. The coupling coordination degree of Guizhou Province and

Jiangxi Province exceeds Chongqing City for the first time. Meanwhile, the two provinces saw the fastest growth rates from 2015 to 2019 of 36 percent and 28 percent, respectively.

The coupling coordination degree of tourism and economy in the Yangtze River Economic Belt develops from east to west, with Jiangsu Province, Zhejiang City, Shanghai and Sichuan Province as the center. Jiangsu, Zhejiang and Shanghai have superior geographical location, convenient transportation and rich human and material resources. Among them, Jiangsu takes advantage of its own advantages and has reasonable industrial distribution. Among the cities with the highest GDP in China, Jiangsu accounts for 3. As the core of Southwest China, Sichuan Province enjoys the support of national policies and the transfer of industries from coastal cities to inland areas, all of which make its economy at a higher level than other southwest regions. Hunan, Hubei and Anhui provinces are located in the middle reaches of the Yangtze River. Anhui and Hubei have a strong foundation of heavy industry, and the government pays little attention to the tourism industry, so the tourism industry is relatively backward compared with the regional economy. Hunan Province has diversified ethnic culture and developed entertainment industry. The tourism industry of Hunan Province has been growing faster than the regional economy in recent years.

4. CONCLUSIONS AND SUGGESTIONS

4.1 Conclusion

(1) The comprehensive tourism development index of 11 provinces and cities along the Yangtze River Economic Belt showed a trend of fluctuation and rise, among which the comprehensive tourism index of Yunnan Province developed the fastest, increasing by 0.4 units. The difference of tourism industry between regions decreased to 0.02 units.

(2) The comprehensive economic development index of provinces and cities in the Yangtze River Economic Belt region showed an overall trend of increase, among which the comprehensive economic development index of Jiangsu Province grew the fastest with an increase of 0.46 units, while that of Yunnan Province grew the slowest with an increase of 0.16 units. Economic disparities between regions increased from 0.33 units in 2010 to 0.64 units in 2019, indicating unbalanced economic development among regions.

(3) The coupling coordination degree of the Yangtze River Economic Belt region is on the rise, Yunnan Province and Jiangxi Province have the fastest growth rate, while Zhejiang Province and Shanghai have a slow growth rate. The degree of coupling coordination in this region formed a diffusion trend from east to west, and formed Jiangsu, Shanghai and Zhejiang as the core in the east, and Sichuan as the core in the southwest.

4.2 Suggestions

From 2010 to 2019, provinces and cities along the Yangtze River Economic Belt developed their regional economies and tourism industries, and there is still much room for improvement. The Yangtze River Economic Belt should form a tourism and economic development pattern with Shanghai, Hubei and Sichuan as the core. To construct a management organization to coordinate various resources in the upper, middle and lower reaches of the Yangtze River, promote the division of labor and cooperation among provinces and cities, highlight the

characteristics of their tourism resources, avoid the homogeneous competition of tourism products, and realize information sharing.

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