

Using spatial misalignment Method to Measure and Evaluate unbalanced regional tourism development in Southwest China

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Abstract

“China's Western Development Policy” has brought multiple opportunities to the development of tourism in Southwest China including Sichuan, Guizhou, Yunnan, Chongqing and Tibet. The 4 provinces and 1 municipality overall show a certain degree of accumulation effect and coordinated development in tourism due to their location, traffic and traditional economic cooperation. This study takes the Southwest China as the research object and utilized the spatial dislocation model and the tourism spatial misalignment index to estimate the mismatch degree between tourism resources and tourism income among provinces and try to find out the internal reason background. The results show that each of the five provinces has its own advantages in index of economy, tourism resources, human resource, and transportation, leading to differences in the center of gravity of the entire region in all aspects. In view of the results of spatial dislocation analysis, suggestions for improvement and optimization are put forward to promote the high-quality development of tourism in Southwest region. development.

Keywords: A-level scenic spot; Tourism income; Spatial dislocation; Gravity model; Two-dimensional matrix model

1. INTRODUCTION

Southwest China, which includes Sichuan, Yunnan and Guizhou, Tibet and Chongqing, abounds in world-class tourism resources. Sichuan alone boasts sites on the UNESCO World Heritage List such as Jiuzhaigou, Mount Emei, Leshan Grand Buddha, Dujiangyan, Mount Qingcheng and the giant panda habitat. Since the implementation of the western development strategy, the western region's economy has achieved considerable development and the ecological environment has been continuously improved. The tourism industry in southwest China has developed rapidly and has gradually become an important pillar industry to drive the economic development of Southwest China. Geographically, the five provincial units are economic and geographical units closely connected in their own systems. The joint development of tourism in these four provinces and one municipality (Chongqing) will help to increase new economic growth points and enhance cultural cohesion, create a new normal of the economy and new forms of cultural business, enhance the visibility and reputation both at home and abroad, and bring material benefits and spiritual enjoyment to urban and rural residents.

With the continuous development of the economy and the state's policy support for the western region, the proportion of tourism revenue in the southwest region in the national tourism revenue has been increasing year by year. The proportion of total tourism revenue in the southwest region in the total tourism revenue of the

country has risen from 37.43% in 2015 to 62.78% in 2019, and is developing rapidly. From 2018, the southwestern region has expanded competition with the strong eastern coastal provinces in our traditional impression in the tourism industry, accounting for more than 50% of the national tourism market. In 2019, the tourism revenue of the most important three southwestern provinces---Sichuan, Guizhou and Yunnan, all break the 1 trillion-yuan mark, ranking among the top six tourism provinces in China. The total tourism revenue of the entire southwestern sector increased to 62.78% of the country, becoming a national tourism hotspot. Among them, Guizhou received 969 million tourists in 2019, ranking first in the China with dazzling results.

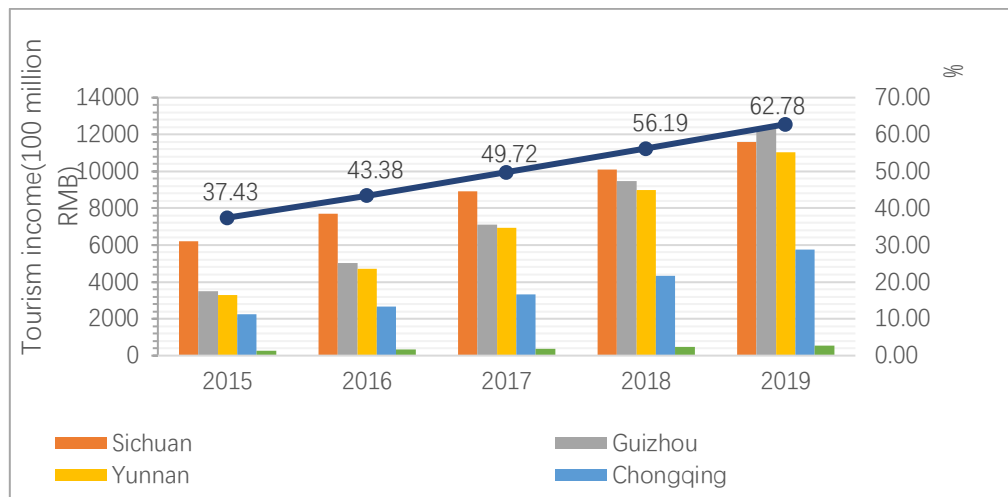


Figure 1. The tourism revenue of the Southwest China and the market share in China

However, there are still many factors that lead to the uncoordinated development of input and output in the tourism industry, and tourism resources have not yet been fully utilized rationally. The main hypothesis of this research is to select appropriate indicators from various aspects to quantify the coordination of resource input and tourism output, and visually analyze the unbalanced development of regional tourism economy among provinces.

Unlike most studies dealing with the evaluation of micro-level efficiency, this paper tries to use a scientific, reasonable, rigorous and feasible research methods to make a practical evaluation and in-depth research on the tourism input/output analysis in the Southwest China which is of great significance to improve the resource utilization rate, realize tourism transformation and upgrading.

The remainder of this research is systematized as follows. Section 2 presents the results from previous relevant researches. Section 3 provides research methodology by combining the gravity model and two-dimensional combination matrix to analyze deeply the degree of spatial dislocation among various elements, as well as data collection procedure and descriptive statistics. Section 4 contains research results, including complete data analysis procedure. Finally, Section 5 concludes the empirical results while highlighting the potential advantages and limitations of such an analysis, along with recommendations for policymakers and other stakeholders.

2. LITERATURE REVIEW

The unbalanced development of regional tourism economy is a hot topic in academic research which is a common phenomenon. Tourism revenue can indicate the operating conditions of regional tourism economy, and comprehensively measure tourism economic activities and their performance [1]. It is affected by factors such as tourism resources, traffic, Number of employees, GDP [2], Policy and etc. The study of tourism economy from a spatial perspective is the method currently adopted by most scholars, and many research results have been generated [3]. The spatial dislocation theory is firstly submitted by Kain's in 1968 on the research of the dislocation relationship between rental housing and job suburbanization [4] for the Vulnerable

Groups of Black Americans, which was published in the America “the Quarterly Journal of Economics”. Then it was gradually applied in the fields of economics and geography [5]. Arnott proposed several models on the spatial mismatch hypothesis based on the study of spatial dislocation theory, and did research on urban labor market space and race [6]; Zenou developed a method based on this theory to increase the level of black subsidies and reduce Search matching model of unemployment rate [7]. Zax, Galster, Gordon and others have used spatial dislocation theory to study the commuting distance, commuting time and other issues in detail [8-10]. In the empirical study of spatial dislocation, regression models are mostly selected for computation, combined with GIS and spatial measurement [11]. Many scholars selected various influencing factors based on the spatial dislocation theory to research on specific cities or regions: Northeast, Guangdong-HongKong-Macao, Heilongjiang, Jiangsu, Beijing, Anhui and other places are common research objects. Wang Xuehan have a study on tracking Evolution of the center of gravity of tourism resources in the Guangdong-Hong Kong-Macao Greater Bay Area [12]. Sun Xiao select the number of tourists and the abundance of tourism resources as the input index to get the misalignment index to quantitatively analyze the dislocation phenomenon of tourism space in 12 cities in Heilongjiang Province [13]. Tong Yuquan used gravity model and two-dimensional matrix combination method to study the spatial misalignment between tourism performance and tourism resources, tourism reception capacity of 13 cities in Jiangsu Province [14]. Tieshan sun analyzed the sector differences of the spatial mismatch between residents and jobs in Beijing by calculating the dislocation index [15]. Based on the actual data of tourism resources of 16 cities of Anhui Province, location and tourism economic income, Hong Zhang discussed the problem of the spatial dislocation of Anhui's tourism resources, location and tourism economic development [16].

Scholars have carried out rich research on the spatial distribution of resources, the temporal and spatial evolution of scenic spots, and the efficiency of tourism economy. The research scope covered national scale, regional scale, provincial scale, city scale, etc. Theory of spatial dislocation, and the gravity model and two-dimensional combined matrix analysis method is currently the mainstream trend way of analyzing regional tourism economy, which is strong convincing with empirical evidence. From overall perspective, most of the research are focus on the spatial dislocation relationship between tourism resources, tourism reception capacity and tourism performance. While the research on the comprehensive performance balance of the development of regional tourism industry is still insufficient. Few other factors are included in the scope of research such as A-level scenic spots, traffic and inbound tourism, especially in Southwest region. Therefore, this article studies the relationship between the abundance of A-level scenic spots and the spatial dislocation of tourism income in various provinces, using gravity models, two-dimensional matrix models and tourism spatial dislocation indexes. Taking the Southwest China as research object, this paper analyzes the unbalanced development of the tourism industry and the reasons for their formation, so as to provide theoretical support for promoting the transformation of the tourism industry in the regional coordination development from scale and speed expansion to quality and efficiency development.

3. MATERIALS AND METHODS

3.1 Research Methodology

3.1.1 Research Index

Incorporating the quantified value of tourism resources, total tourism revenue, traffic miles, economic development, total number of tourists and other data into formula (1), and carrying out range standardization processing to obtain the index value of each indicator, which are used as the measurement of analysis index. The original data comes from the 2019 National Economic and Social Development Statistical Bulletin of each province in Southwest China.

$$T_i = \frac{|Q_i - Q_{min}|}{|Q_{max} - Q_{min}|} \times 100 \quad (1)$$

Among them: T_i indicates the index value of each indicator; Q_i indicates the value of an indicator in a province i ; Q_{min} indicates the minimum value of an indicator in provinces; Q_{max} represents the maximum value of an indicator in provinces.

3.1.2 Abundance Index of Tourism Resources

The resource abundance of scenic spots refers to the richness and combination of the number of scenic spots in a certain sub-region relative to the resource types of tourist spots in the upper-level region. It relates to the economic benefits of the region, which affects people's travel experience and satisfaction, and behavior intentions such as willingness to revisit or not. Since A-level scenic spots are a standard criterion for the attractiveness of characteristic tourism resources in a region, the resource abundance index of scenic spots can be selected here. First of all, a dimensionless calculation of the number of units of A-level scenic spots in each province in Southwest:

$$\theta_{ij} = \left| \frac{\lambda_{ij} - \lambda_{jmin}}{\lambda_{jmax} - \lambda_{jmin}} \right| \quad [13](2)$$

Among them: θ_{ij} represents the standardized value of j -level scenic spots in province i ; j represents the level of 1A~5A scenic spots; λ_{ij} represents the local number of j -level scenic in i province; λ_{jmin} and λ_{jmax} respectively represent the endpoint and replacement of the j -level local number.

It is possible to summarize the index of the proportion of various provinces' tourism resources in the province into a comprehensive indicator A that reflects the absolute abundance of provincial tourism resources as a whole. Secondly, use the calculation of the abundance index of A-level scenic spots in five provinces in Northwest China:

$$T_i = 5.0\theta_{i5} + 2.5\theta_{i4} + 1.75\theta_{i3} + 0.5\theta_{i2} + 0.25\theta_{i1} \quad (3)$$

Among them: T_i is the abundance index of A-level scenic spots in i Province; $\theta_{i1}, \dots, \theta_{i5}$ refer to the standardized values of 1A ~ 5A level scenic spots in province i calculated according to the standardized formula by the end of 2019, the data comes from the official website of the Department of Culture and Tourism of each Province; we refer to previous research models [17], 0.25, 0.5, 1.75, 2.5, 5.0 represent the weight of the A-5A-level scenic spot.

3.1.3 Gravity Model

In geometry, the center of gravity refers to a point in the regional space where the power of the surrounding elements reaches a balance. Gravity model is often used in the study of regional economic spatial structure to reflect the location relationship and spatial organization of economic things in the carrier of geographic space [18]. It emphasis the point that can maintain balance in all directions in a certain area [19]. The gravity model can be used to calculate the center of gravity of tourism resources, population, economic development, total number of tourists, and total tourism revenue in Southwest China.

$$X_z = \frac{\sum_{i=0}^n T_i \times X_i}{\sum_{i=0}^n T_i}, \quad Y_z = \frac{\sum_{i=0}^n T_i \times Y_i}{\sum_{i=0}^n T_i} \quad (4)$$

Among them: X_z, Y_z indicates the latitude and longitude of the center of gravity of the spatial distribution of an index in Southwest China; T_i indicates the value of an index in province i ; X_i, Y_i indicates the latitude and longitude of the administrative center of gravity in province i ; n is the number of provinces in Southwest, that is, $n=5$.

3.1.4 Tourism Spatial Misalignment Index

This index can further calculate the specific degree of the spatial misalignment of A-level scenic spots in Southwest China and tourism income. Combined with the research results of Li L. Yan and other scholars [20]

$$SMI_i = \frac{E_i - \left(\frac{T_i}{T}\right) \times E}{E} \times 100 \quad (5)$$

Among them: SMI_i is the Spatial Misalignment Index of tourism in each province; T_i is the resource abundance of scenic spots in province i in Southwest China, T is the total abundance of scenic resources in five provinces; E_i is the tourism income index of province i, and E is the total tourism income index. If $SMI_i > 0$, it means that the actual tourism income brought by the resources of the tourist attractions in the i-th province exceeds the expected income; if $SMI_i < 0$, the opposite is true; if $SMI_i = 0$, the actual tourism income brought by the tourist attractions of the province Equal to expected income.

3.1.5 Other related Index

Below index are used for further related analysis:

$$M = \frac{T}{S} \quad (6)$$

Among them: M is the Traffic network density index; S is the area in Square kilometers, T is the Number of constructed traffic kilometers in the area.

$$F = \frac{\sqrt{\sum_{i=1}^n x_i^2}}{m} \times 100 \quad (7)$$

Among them: F is the geographic concentration index, x_i is the number of scenic spots in the i-th city, n is the number of cities, and m is the total number of scenic spots. The value of F ranges from 0 to 100. The larger the value of F, the higher the concentration of tourist attractions.

3.2 Variable selection and data source

Tourism is a comprehensive industry with complex and diverse input and output indexes. At present, researchers have not reached consensus on the choice of input and output indexes. But we can simply the input indexes into visible tourism resource and output indexes into tourism revenue. The total tourism revenue usually includes many information such as the number of tourists, consumption power and prices in the tourist area. Compared with other indicators, it is more comprehensive and intuitively representative of the tourism economic level of each province. Therefore, the total tourism revenue is used to measure the tourism economic of each province. The source of tourism income can be divided into domestic tourism income and international tourism income. International tourism income is also called tourism foreign exchange income. It is very different in marketing from domestic ones. It can reflect the international attractiveness of scenic spots to a certain extent. Here it is called as inbound tourism revenue and also used as an index to measure the difference among provinces.

A-level scenic spots are determined by the Provincial Tourism Bureau after being authorized by the National Tourism Attractions Quality Rating Committee and evaluated in accordance with the standards of "Classification and Rating of Quality Grades in Tourist Attractions". Their resource value, location conditions, and tourist reception service capabilities are all certified. It is an important symbol to measure the quality of a scenic spot, a display card of a region's characteristic resources, and a basic condition for the growth of a region's tourism economy and the development of the tourism industry. It is highly representative. By SMI (5),

we can compare provinces in Southwest China to find out which one is more efficient in utilizing resources and which one still have much opportunities. And we can easily find out which one is leading in some aspects of resources development such as human resource and traffic. The quantity of tourism direct employment is an ideal index of labor factor input, but there is a lack of statistics on this data in the statistical yearbook of China, so the quantity of employment in the tertiary industry is chosen to replace this variable, as taken as human resources index. In this paper, the traffic index is measured by the Total length of highway, because it is more representative in traffic accessibility of tourist attractions among scene spots and cities in the province than the railway. According to the statistical yearbooks of each province, road passenger traffic accounted for more than 80% of the total passenger traffic in 2019, and the urban internal transportation infrastructure is the most important factor affecting service support factors.

The research scope of this paper covers in Sichuan, Guizhou, Yunnan, Tibet provinces and Chongqing municipality, and the data of tourism input and output indexes from 2015-2019 are taken as the research samples. Part of the data is from 2019. The data for 2019 is very representative and shows the current development situation. Because it can be seen from Figure 1 that the development is very rapid. From 2015 to 2019, the market share of southwest region in China has increased rapidly at 6% per year. Guizhou's annual growth rate has reached 30% in the last three years. Sichuan, which has the lowest annual growth rate among the five provinces, also has 13%. In this case, using some mean values loses the meaning of studying the current situation. However, in 2020, the data is not suitable for comparison because of the different epidemics in each province.

All data are from statistical yearbooks of all provinces, China City Statistical Yearbook, China Regional Economic Statistical Yearbook, official websites of National Tourism Administration, official websites of provincial and municipal tourism bureaus, and statistical bulletins of national economic and social development of all regions.

4. RESEARCH RESULTS

4.1 Abundance index of tourism resources analysis results

Tourism resources are the foundation of tourism development, and the quality and distribution of tourism resources will directly affect the development direction and development potential of the tourism industry. According to formula (2) and (3), the result can be showed in Figure 2.

The overall abundance index of tourism resources can be divided into 3 levels: Top level--- Sichuan; 2nd level--- Guizhou, Yunnan and Chongqing; bottom level --- Tibet. The index of Top level has more than 2 times the resources than the 2nd level. There is an order of magnitude difference between level 2 and level 3. Sichuan has very huge and rich tourism resources, especially the number of 2A scenic spot. Guizhou, Yunnan and Chongqing have close index and Guizhou has a weak advantage. The resource in Tibet is very limited, which need to pay more attention on resource development.

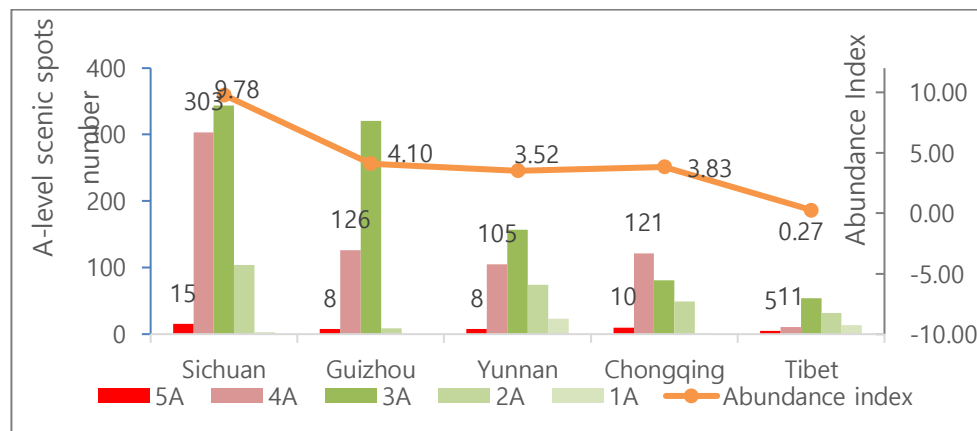


Figure 2. The Statistics of the number of A-level scenic spots and the Abundance Index of Tourism Resources in Southwest China in 2019

4.2 Other related indexes analysis results

The development of tourism resources requires a certain economic base for investment, including supporting transportation resources. When other conditions are fixed, the richer the tourism resources, the greater the tourist attraction, the stronger the motivation for tourism, and the larger the scale of the tourism economy. Tourism is a labor-intensive industry, which can promote employment and drive the development of the tertiary industry. According to formula (1)(6)(7), we can get the result as showed in Table 1:

Table 1. Overall standardized index and related index in provincial level in Southwest China in 2019

	Sichuan	Guizhou	Yunnan	Chongqing	Tibet
<i>Overall Standardized Index (0-100)</i>					
Tourism revenue index	93.839	100	89.084	44.047	0
Inbound tourism revenue index	35.838	1.355	100	46.13	0
Economic Development Index	100	33.743	48.193	49.048	0
Employment Index	100	28.096	61.171	40.913	0
Location Accessibility Index	100	43.2	67.954	30.159	0
<i>Other Related Index</i>					
Traffic network density	0.694	1.162	0.666	2.115	0.085
Scenic spot concentration	25	38.9	29.6	100	55.5

According to these normalized values, we can easily find out that Sichuan has the strongest economic background, the best location accessibility, and the most human resource supported in tourism. But it does not get the top one in tourism income, especially in the inbound tourism revenue. In replace of it, Guizhou achieved a dazzling total score in conditions of the worst economic background except Tibet. And it still has a lot of chance in promoting inbound tourism. Guizhou's advantage lies in its rich tourism resources. From perspective in combined with the 3 index--- Location Accessibility Index, Traffic network density and Scenic spot concentration, we can see that although it is not best in total traffic construction, its scenic spots are much more concentrated than Sichuan and Yunnan. What's more, it has constructed much higher density traffic than others except Chongqing. This situation is related to its development strategy and policy. From the raw data, we can see the tourism income has accounted for more than 70% in provincial GDP. That means Guizhou's tourism industry has become the "pillar" of Guizhou's economy. Yunnan has also achieved excellent tourism revenue performance. In conditions of that its economic index is only half that of Chongqing, and its abundance index of tourism resources is similar to that of Chongqing, it has achieved twice the total tourism revenue of Chongqing.

4.3 Gravity model analysis result

From above analysis, the imbalance between tourism and economic development in Southwest China is existed. Gravity model can give us a more intuitive perspective. According to formula (4), we can input the different indexes and calculate out the related different gravity center's spatial location as showed in Figure 3:

From perspective in this map, all the centers are located in the border of 5 provinces. if taking the position of economic center as the origin, we can see the center of tourism resources and human resources are almost overlapped and very close to the origin, slightly to the west. That means the whole tourism resources in southwest region is developed in harmony with the economy and the position slightly to the west is also align with the policy of western development. The center of location accessibility is far away in the west to the origin. It is because that Tibet has an order of magnitude difference in the resource abundance of a-level scenic spots comparing to other provinces, while its traffic resources are not so miserable. The center of tourism

revenue is in the southeast of the center of resources and toward to the direction of the Guiyang city, which is the capital of Guizhou province. It means tourism economy in Sichuan and Chongqing is not so good as Yunnan and Guizhou, especially Guizhou. The Center of inbound tourism revenue has much faraway position and toward to the direction of Kunming city, which is the capital of Yunnan province. It is because tourism in Yunnan has much more international prestige and influence than other provinces.

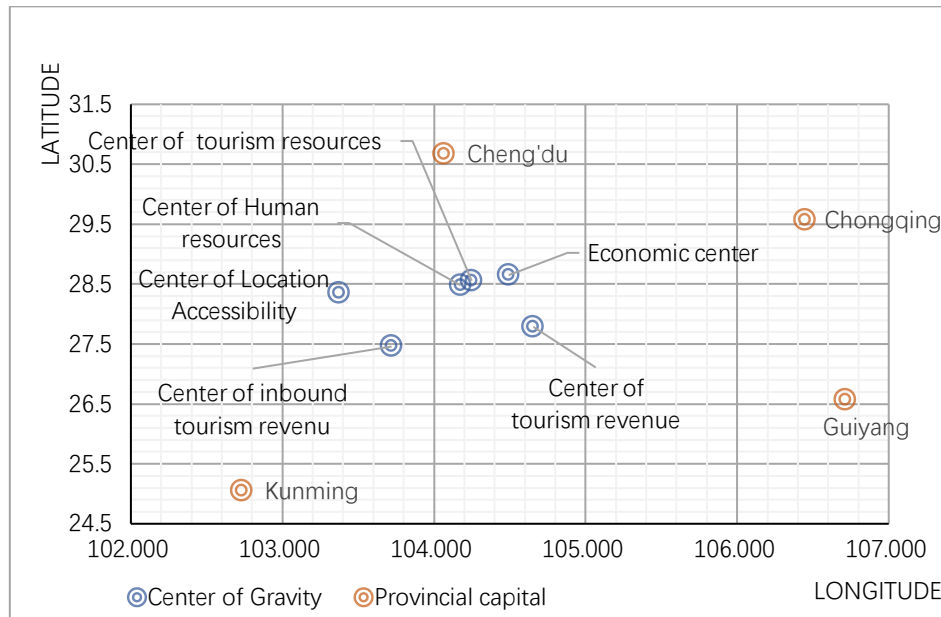


Figure 3. The gravity centers of tourism resource, outputs and economy with provincial capital location in Southwest China Map

4.4 Tourism spatial misalignment index analysis results

The gravity model shows the distribution of the center of gravity and the degree of spatial dislocation of various indicators from a macro perspective [21]. In this section we use formula (5) to quantify the degree of imbalance in regional tourism development. The result is showed in table 2:

Table 2. Spatial misalignment index of tourism resources and tourism income in provincial level in Southwest China in 2019

		Sichuan	Guizhou	Yunnan	Chongqing	Tibet
SMI	Total Tourism	-11.935	5.061	10.061	-0.060	-3.127
	Inbound Tourism	-20.434	-21.461	33.184	10.491	-1.779

Due to inbound tourism revenue is only a very small percentage of total tourism income (less than 3% overall), we should focus on the first row of this table and make the 2nd row as a supplement and reference. We could see the SMI value of total tourism revenue for Chongqing is almost equal to zero, which means it perfectly matches the tourism resources. Its input and output of the tourism industry are relatively ideal. Yunnan got the positive maximum value which indicate it fully utilizes tourism resources to generate economic benefits. On the opposite, Sichuan got the negative maximum value which indicate its tourism industry still have a lot of potential to be tapped. Sichuan's economic index and tourism resource index are both more than twice that of other provinces so that its tourism input and investment is advanced, and the potential of the tourism economy will be released in the next few years. Guizhou also obtained significant positive result while its inbound tourism still has more opportunities. Tibet achieved a negative value but did not deviate too much

from the zero point especially the inbound tourism.

4.5 Two-dimensional combination matrix comprehensive analysis results

To understand the specific spatial dislocation of tourism resources and tourism revenue, we could use Two-dimensional combination matrix as Figure 4 to do further analysis:

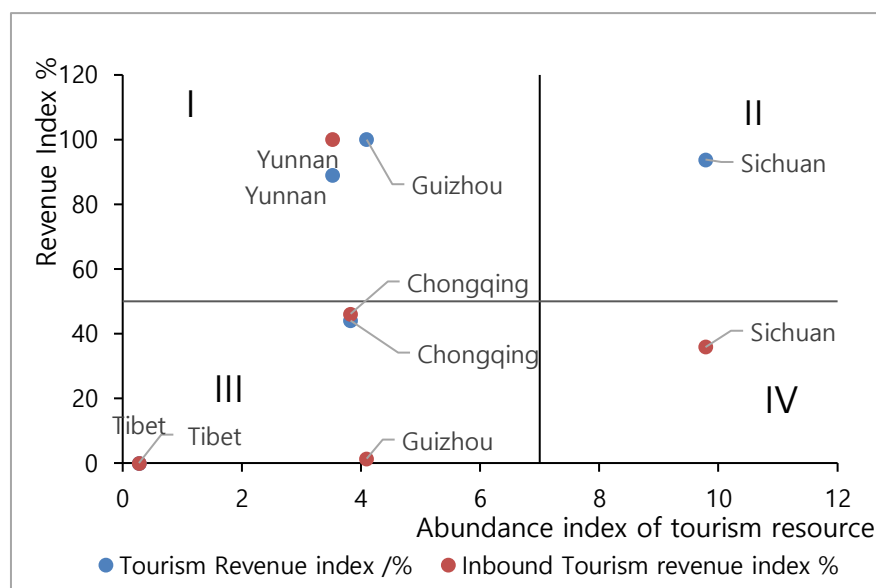


Figure 4. Matrix of tourism revenue index and abundance index of tourism resources

According to the Scatter plot, it could be divided into 4 areas by median value. Zone I is low resource with high revenue, which show the best performance. Yunnan has two points dropped here and Guizhou has one point here. Zone II is high resource with high revenue, which is also a good zone with a lot potentiality and opportunities. Sichuan has one point dropped here. Zone III is low resource with low revenue. Chongqing is in the top of this zone and close to the median revenue line. It could enhance the performance in conditions of its available resource and enter into zone I. Tibet has 2 points overlapped near the origin, it still has a long way to catch up with its neighbors, both in investment and performance. Zone IV is high resource with low revenue, which is the worst performance. That means inbound tourism in Sichuan is still in a low level and does not match the status of a major economic and resource province. There are totally two province--- Sichuan and Guiyang, each of which has its two points scattered in different zone. It means unbalanced efforts in tourism development which led to weak points.

5. CONCLUSION

This article empirically analyzes the degree of tourism spatial dislocation in the five southwestern provinces by constructing a measurement model of tourism spatial misalign. The results show that each of the five provinces has its own advantages in index of economy, tourism resources, human resource, and transportation, leading to differences in the center of gravity of the entire region. In general, Yunnan and Guizhou are in a positive dislocation state, and they have excellent performance in tourism economy. Especially in Guizhou Province, tourism has become the leader industry in economic development of the province, driving other related industries. Yunnan's tourism industry is also close to contribute half of the province's total GDP. The degree of dislocation for Chongqing and Tibet is relatively small, and their resource development is coordinated with overall economic. Although Tibet's resources are very limited and the economy is low, its tourism still accounts for one third of the province's GDP. It needs more policy support and surrounding economic entities to drive. Sichuan is in a high negative dislocation state while it has a high abundance of

resources. There is still a lot of space for the development of tourism in Sichuan.

In general, there are serious regional differences and imbalances in the development of regional tourism economy in Southwest China. It also reflects that the advantages of rich tourism resources in many places in Southwest China have not been fully utilized, and there is still huge potential development in regional tourism economy. The current tourism development in Southwestern China has shown significant spatial agglomeration, showing a certain scale economies effect; but there are still spatial differences in tourism income in different provinces, and the problem of regional development imbalance still exists. Each province needs to take targeted measures to improve and optimize the tourism industry according to its own characteristics and the current situation of the industry, so as to better improve the efficiency of local tourism and promote the development of the industry.

Southwest China has a large area of diversified landforms and is a gathering place for ethnic minorities. It has rich natural and cultural resources, a large population and sufficient labor force, which provides a great development space for the tourism industry. In recent years, the economy of the western region has been developing rapidly, and the transportation and investment environment in the southwest have been significantly improved. Under the background of "Western Development strategy", the construction of the "One Belt One Road" have established connections between the southwest region and cities along the route. Both domestic cities and countries in Southeast Asia have strengthen the economic ties with the Southwest China. It brings greater development chances for the tourism of the Southwest China.

As so far, it should be noted that the results obtained by utilizing the spatial misalignment method are relative measurements and that there are other controlled and uncontrolled factors. For instance, due to the constraints of data availability, this paper mainly selects the number of A-scenic spots data to replace the whole resources in tourism, which reduces the other resources such as national-level scenic spots, Chinese historical and cultural cities, national-level forest parks and other types of tourism resources. However, as tourism is a comprehensive industry with strong correlation, it can also explain the problem to some extent. In addition, only 2015-2019 data is used in this paper and some indexes focus in 2019, which has a short time span and some limitations, so it needs further study and improvement.

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