Research on Spatial-temporal Pattern of Coupling and Coordinated Development of Urban Highway Traffic and Tourism Economy in Anhui Province

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ABSTRACT

Based on the data of transportation and tourism economic development in Anhui province from 2010 to 2019, this paper introduces the coupling coordination degree model for analysis. The results show that there is a coupling relationship between urban traffic and tourism economy in different cities of Anhui Province, and the coupling coordination gradually changes from imbalance to coordination, and the spatial difference of coupling coordination is obvious, which provides intellectual support for the coordinated development of urban traffic and tourism economy in Anhui Province.

Keywords: *Highway traffic; Tourism economy; Coupling coordination; Anhui Province*

1. INTRODUCTION

Transportation is the foundation of a region's tourism development, in the era of all-for-one tourism, the travel mode of tourists has changed, and "on the road" has become a new way of tourism experience. Nowadays, self-driving tours, cycling, hiking and other tourism experience modes are favored by tourists[1]. As an important basic support for tourism activities and tourism flows, urban road traffic is an important carrier to promote tourism development, and the relationship between road traffic and tourism economy is increasingly becoming one of the hot topics in tourism research[2], which is not only the actual needs of tourism development, but also an important academic proposition of cross-study of tourism geography and traffic geography[3]. Based on this, this paper discusses the related issues of highway traffic and tourism economy on the basis of the analysis of coupling coordination between highway traffic and tourism economy development in Anhui Province.

2. RESEARCH METHODS AND DATA SOURCES

2.1 Coupling coordination model

Build a coupling evaluation model of highway traffic and tourism economy. The formula is:

$$C = 2\{(u_1 \times u_2)/[(u_1 + u_2)(u_1 + u_2)]\}^{1/2}$$

Where C is the coupling degree of the two systems, u_1 and u_2 represent the comprehensive development level of highway traffic and tourism economy. The value of coupling degree C is [0,1].

However, the deficiency of this model is that when both systems are at a low level of development, a highly coupled result can be obtained. Therefore, based on the coupling degree model, the coupling coordination degree model is introduced to judge the coordinated development degree of the two systems [4], the formula is as follows:

$$D = \sqrt{C \times T}, \quad T = \alpha u_1 + \beta u_2$$

Among them, D is the coupling coordination degree, C is the coupling degree, T is the comprehensive coordination index of urban transportation and tourism economic development, α and β are undetermined

coefficients. Since the two systems are of equal importance , both α and β and are 0.5[5].

The coupling coordination level is determined by the evaluation standard of coupling coordination, and the classification of coordination levels can be divided into many kinds. Because the difference between the coupling coordination levels of the comprehensive development level of urban road traffic and tourism economy in every cities in Anhui Province is small, in order to see the differences, on the basis of referring to the research of Wang Yongming and others [6], the coupling coordination levels are divided into ten intervals and levels by the uniform distribution method.

2.2 Index system construction

In this paper, taking the highway as an example, referring to previous studies [6], the traffic index system is divided into seven indexes: highway passenger volume, highway turnover, the number of highway routes arriving at the end of the year, highway density, the ownership of highway operating vehicles, the ownership of private vehicles and the ownership of vehicles per 10,000 people. The selection of tourism economic index system is mainly based on several aspects that have made great contributions to the tourism economy in the tourism system. On the basis of previous studies [11], the index system of tourism economy is divided into six aspects: the number of inbound tourists, tourism foreign exchange income, the number of domestic tourists, domestic tourism income, the number of star-rated hotels in the city and the number of tourist attractions above Grade A.

2.3 Data sources

The index data for measuring the coupling coordination level between urban highway traffic and tourism economy needed in this paper is mainly based on the official statistical authoritative data, mainly from Anhui Statistical Yearbook from 2011 to 2020, and the statistical bulletins of every cities . The method of mean replacement is used to deal with the missing data.

3. RESULT ANALYSIS

3.1 Spatial-temporal analysis of comprehensive development level of highway traffic

The development level of urban highway traffic in 16 cities in Anhui Province from 2010 to 2019 is calculated. The results show that the comprehensive development level of highway traffic in 16 cities in Anhui Province is on the rise in 2010 to 2019, and the comprehensive development level of highway traffic in each city has been improved to varying degrees. Among them, Hefei's highway traffic development level is

ahead of other cities, and the growth rate is nearly 0.454, which is closely related to its status as the provincial capital. The comprehensive development level of highway traffic in Anqing, Ma 'anshan and Wuhu was followed by the growth rate of over 0.17. The growth rates of Huangshan, Suzhou, Bozhou, Huaibei and Fuyang all exceeded 0.1. The growth of other cities is slow, among which Tongling and Xuancheng are the cities with the slowest growth in the comprehensive development level of highway traffic in Anhui province, which may be related to Tongling being a small city in Anhui province with less traffic construction. In 2010 and 2019, Hefei, Fuyang and Lu 'an are always the top three cities, which belong to the category of high and steady growth. The comprehensive development level of traffic in these three cities has maintained steady growth in time series, which may be related to Hefei being the capital of Anhui Province, Fuyang and Lu 'an being cities with large areas and large populations in Anhui Province.

The overall growth rate of the comprehensive level of highway traffic in every cities in Anhui Province is on the rise, but the rising range among each city fluctuates greatly, and the development speed is different. Among them, the cities with faster development should continue to maintain, and the cities with lower comprehensive traffic development level should increase the development of highway traffic to promote the healthy development of all aspects of the city.

3.2 Spatial-temporal analysis of the comprehensive development level of tourism economy

According to the calculation, from the time series point of view, the development level of tourism economy in all cities in Anhui Province has achieved steady growth on the whole, with the exception of Chuzhou, which has changed greatly, and the change of rank among cities is relatively small. From the space point of view, there is still a gap in the comprehensive development level of tourism economy among cities in Anhui Province, among which Huangshan, Chizhou and Hefei have a relatively high level of tourism economy development. Huangshan and Chizhou are typical tourist cities with rich tourism resources and high popularity. Hefei, as the provincial capital city, has a broad tourist market and strong economic development, and its tourism economy ranks third. According to the calculation, cities in Anhui Province can be divided into five regions by ranking the comprehensive development level of tourism economy. Hefei represents the central Anhui region with a high comprehensive development level of tourism economy, Chuzhou represents the eastern Anhui region with a gentle comprehensive development level of tourism economy, Huangshan

represents the southern Anhui region with a outstanding comprehensive development level of tourism economy, Lu 'an represents the western Anhui region with a steady increase in the comprehensive development level of tourism economy, and Suzhou represents the northern Anhui region with a low comprehensive development level of tourism economy.

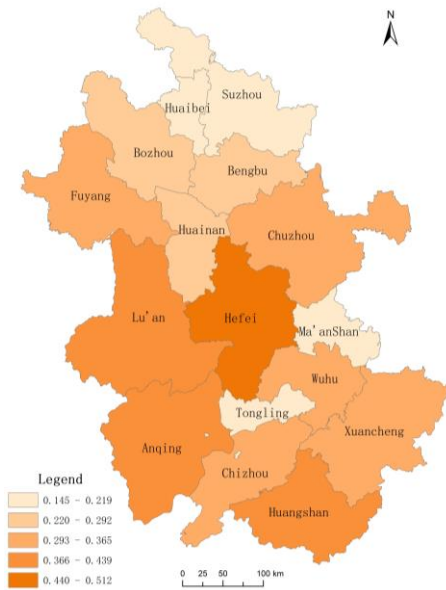### 3.3 Analysis of coupling coordination level of highway traffic and tourism economy

Figure 1 coupling coordination degree between two systems in 2010.
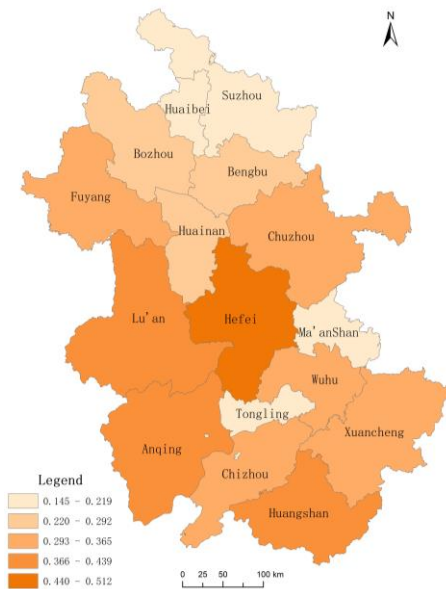

Figure 2 coupling coordination degree between two systems in 2019.

Through calculation, the coupling degree of highway transportation and tourism economy in 16 cities in Anhui Province is more than 0.5, indicating that there is a coupling relationship between the development of urban highway transportation and tourism economy. Coupling coordination degree of all cities in Anhui Province has improved to varying degrees. The fastest growth rate is Hefei, with an increase of nearly 0.3. Hefei, Anqing and Lu'an remain the first three places unchanged. In 2010, the last four cities in the rank of coupling coordination degree were Huaibei, Tongling, Suzhou and Ma'anshan; The last four cities in 2019 are Fuyang, Chuzhou, Huaibei and Suzhou, of which Suzhou and Huaibei have always been at a low level. Ma'anshan jumped from 13th in 2010 to 7th in 2019, making it the city with the largest span; Chuzhou and Fuyang both fell by 7 orders. In 2019, the coupling coordination degree of Hefei, Wuhu, Anqing and Lu 'an in Anhui Province reached above 0.5; the coupling coordination values below 0.3 include Huaibei, Tongling, Chuzhou, Fuyang and Suzhou. On the whole, the coupling and coordination level of highway traffic and tourism economy in every cities in Anhui Province has improved slightly, but there are still great differences in spatial distribution.

Through calculation, the coupling types of all local cities in Anhui Province were in a state of imbalance in 2010, and only Hefei reached primary coordination in 2013 and 2016. In 2019 Hefei achieved good coordination, Wuhu Barely Coordination, Bengbu, Ma 'Anshan, Huangshan, Xuancheng are on the verge of imbalance . Huainan, Bozhou and Chizhou are in a mild state of imbalance, Tongling and Suzhou are in a moderate state of imbalance, Huaibei, Chuzhou and Fuyang are in an extremely unbalanced state, and the overall situation of most unbalanced cities has been alleviated.

4. CONCLUSION AND DEFICIENCY

This paper mainly analyzes the coupling of road traffic and tourism economy in 16 cities of Anhui Province, and introduces the coupling coordination degree model to further analyze the coupling coordination level of urban road traffic and tourism economy. It is concluded that there is a highly coupling relationship between urban highway traffic and tourism economy in Anhui Province. In terms of urban road traffic, hefei, Fuyang and Lu 'an ranked first and third. In terms of tourism economy, the top three cities are Chizhou, Huangshan and Hefei. On the whole, the development level of the two systems in each city is on the rise. The spatial difference of the coupling coordination level between the two systems in each city is obvious, and the coordination level is the best in the middle of Anhui province, while the coordination level in the south, middle and west of Anhui province is obviously higher than that in the north and east of Anhui province. The coupling coordination level between northern Anhui and eastern Anhui is low with

little change in time sequence, especially the coordination level of several cities in northern Anhui is low, which needs to be improved.

In this paper, the coupling coordination degree model is used to analyze the coupling of traffic and tourism economy in 16 prefecture-level cities of Anhui Province. However, as a quantitative value, the coupling coordination degree can only indicate the coordination degree between urban highway traffic and tourism economy, but fails to explain what factors cause the temporal and spatial differences. In future studies, it is necessary to deeply analyze the coupling mechanism and coupling influencing factors and fully explore the internal mechanism between the two systems.

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