



# A Study on The Linkage Between Tourism and Economic Development In The Greater Bay Area Based on Big Data Analysis

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## Abstract

With the rapid development of the construction of Guangdong-Hong Kong-Macao Greater Bay Area, coordinating the relationship between tourism and economic development has become one of the important ways to promote the rapid development of the Greater Bay Area. Based on measuring the level of tourism and economic development in the Guangdong-Hong Kong-Macao Greater Bay Area, this paper analyzes the tourism and economic development patterns of a total of seven places in the Guangdong-Hong Kong-Macao Greater Bay Area from 2016 to 2019 by using entropy-weighted coupling coordination index, exploratory spatial data analysis method and other methods. The results show that there is an uneven development of cities in the Bay Area, and some cities are more backward in development.

**Keywords-***Guangdong-Hong Kong-Macao Greater Bay Area; Tourism Competitiveness; Coupling Coordination; Economic Development*

## 1. INTRODUCTION

Tourism is a product of socio-economic development and an important symbol of rapid economic development and improvement of people's quality of life. The coupled and coordinated development of tourism and economic development is an effective way to achieve regional economic development in the post-industrialization era. The Guangdong-Hong Kong-Macao Greater Bay Area has the world's most dense seaport and airport clusters, which can highlight its diversified tourism experience [1]. In recent years, the economic ties among Guangzhou, Zhuhai, Shenzhen, Hong Kong and Macau have become closer and closer, and from the Pan-Pearl River Delta to the current Greater Bay Area, there is a deep transformation and upgrading of the development concept and economy behind it. This paper explores the coupling mechanism between tourism and economic development in Guangdong, Hong Kong and Macau to provide some references for promoting sustainable economic development in the Greater Bay Area.

## 2. STUDY AREA OVERVIEW AND RESEARCH METHODOLOGY

### 2.1 Study Area Overview

The Guangdong-Hong Kong-Macao Greater Bay Area is located in the southeast coastal region of China, and its economy is well developed, with an area of 55,910 square kilometers, with a total of two special zones in Hong Kong and Macau and nine cities in Guangzhou, Zhuhai, Huizhou, Zhongshan, Zhaoqing, Shenzhen, Foshan, Dongguan and Jiangmen, where the completion and opening of the Hong Kong-Zhuhai-Macao Bridge and the Guangzhou-Shenzhen-Hong Kong Express Rail Link has greatly improved the transportation connections between cities in the Guangdong-Hong Kong-Macao Greater Bay Area. In 2019, the Hong Kong and Macau received more than 95.32 million visitors, and according to the "Guangdong-Hong Kong-Macao Greater Bay Area Tourism Development Report 2019", mainland China has the highest total tourism consumption, accounting for more than 78%, and the total tourism revenue exceeds RMB 200 billion. With the opening of the Hong Kong-Zhuhai-Macao Bridge, tourism in the Greater Bay Area has been better developed, with Hong Kong's hospitality increasing from 41.92 million in 2011 to 65.15 million in 2019, an increase of over 55%. However, there is also the

problem of uneven and unbalanced economic development in the region [2]. How to realize the development of tourism and the economic construction of the Greater Bay Area, and how to achieve a "win-win" situation between tourism and urbanization is an important issue of concern for the government and academia.

## 2.2 Indicator system construction and data sources

According to the urban development index system and weights constructed by Ran Ting, Su Wei word, Zhang Jin (2021), this paper combines the actual situation and constructs the urban economic and tourism and coordinated development index system according to the three major elements of systemic, comprehensiveness, measurability and data accessibility [3]. Data sources and 2011-2019 Guangdong Provincial Statistical Yearbook, Hong Kong Statistical Yearbook, Macao Statistics Bureau and forward-looking database, etc., through the collection and calculation to obtain data, the absence of individual data in a few years, according to the data of similar years using interpolation method to obtain. In addition, for the amount statistics of Hong Kong and Macau, this paper will be uniformly converted into RMB and calculated and analyzed according to the average exchange rate in 2020.

## 3. EVALUATION OF TOURISM AND ECONOMIC DEVELOPMENT IN GUANGDONG-HONG KONG-MACAO GREATER BAY AREA

### 3.1 Construction of Indicator System and Research Methodology

#### 3.1.1 The establishment of tourism and economic development evaluation index system:

Economic development and tourism development level is affected by many factors, this paper draws on the indicators in previous studies to select relevant indicators, and constructs a comprehensive tourism development indicators and economic development evaluation index system [4]. For economic development indicators, this

paper analyzes four dimensions: overall economic development, openness to the outside world, ecological green development, and development results for the people, and a total of 20 indicators are selected for evaluation. For the construction of tourism development level, this paper is conducted from three dimensions, namely tourism market, tourism economy and tourism benefit, and six subdivision indicators are selected for evaluation.

#### 3.1.2 Application of entropy method:

In this paper, the entropy method model after the time-year variable is used to calculate the index weights. At the same time, in order to eliminate the influence of the magnitude, this paper will standardize the raw data as follows.

Positive indicators:

$$Y_{ijt} = \frac{X_{ijt} - \min(X_j)}{\max(X_j) - \min(X_j)} \quad (1)$$

Inverse indicators:

$$Y_{ijt} = \frac{\max(X_j) - X_{ijt}}{\max(X_j) - \min(X_j)} \quad (2)$$

For positive indicators, the higher the value of the indicator indicates the higher level, which will be calculated using formula (1), and vice versa using formula (2).  $X_{ijt}$  denotes the  $j$ th indicator of city  $i$  in year  $t$ ,  $Y_{ijt}$  denotes the  $j$ th indicator of city  $i$  in year  $t$  after standardization,  $\max(X_j)$ ,  $\min(X_j)$  denote the maximum and minimum values of the  $j$ th raw data of all cities from 2011-2019. Meanwhile, this paper uses spss software to analyze and finally construct the weights of each indicator.

### 3.2 Comprehensive evaluation

This paper uses the annual data of a total of 11 cities in the Guangdong-Hong Kong-Macao Greater Bay Area from 2011-2019 for analysis, and uses the entropy value method to construct the research index system, and further calculates to obtain the comprehensive level of tourism development and regional economic development of each Chen Shuguanghi, and the results are shown in Table 1 and Table 2.

### 3.2.1 Comprehensive level of tourism development.

**TABLE I.** COMPREHENSIVE LEVEL AND RANKING OF TOURISM DEVELOPMENT IN GUANGDONG, HONG KONG AND MACAO GREATER BAY AREA, 2011-2019

|               | 2011  | Rank | 2013  | Rank | 2015  | Rank | 2017  | Rank | 2019  | Rank | Average value |
|---------------|-------|------|-------|------|-------|------|-------|------|-------|------|---------------|
| Hong Kong     | 0.233 | 1    | 0.479 | 1    | 0.651 | 1    | 0.731 | 1    | 0.719 | 1    | 0.5626        |
| Macau         | 0.228 | 2    | 0.342 | 2    | 0.486 | 2    | 0.584 | 2    | 0.640 | 2    | 0.456         |
| Guangzhou     | 0.215 | 3    | 0.352 | 3    | 0.368 | 3    | 0.577 | 3    | 0.631 | 4    | 0.4286        |
| Shenzhen      | 0.193 | 4    | 0.284 | 4    | 0.317 | 4    | 0.368 | 4    | 0.634 | 3    | 0.3592        |
| Zhuhai        | 0.176 | 6    | 0.279 | 6    | 0.284 | 6    | 0.339 | 5    | 0.594 | 5    | 0.3344        |
| Foshan        | 0.174 | 7    | 0.248 | 7    | 0.271 | 7    | 0.302 | 6    | 0.521 | 6    | 0.3032        |
| Huizhou       | 0.063 | 11   | 0.098 | 11   | 0.178 | 11   | 0.282 | 8    | 0.518 | 7    | 0.2278        |
| Dongguan      | 0.182 | 5    | 0.281 | 5    | 0.288 | 5    | 0.291 | 7    | 0.462 | 8    | 0.3008        |
| Zhongshan     | 0.122 | 8    | 0.181 | 8    | 0.183 | 8    | 0.203 | 9    | 0.289 | 10   | 0.1956        |
| Jiangmen      | 0.083 | 10   | 0.102 | 10   | 0.179 | 9    | 0.198 | 10   | 0.267 | 11   | 0.1658        |
| Zhaoqing      | 0.102 | 9    | 0.117 | 9    | 0.153 | 10   | 0.183 | 11   | 0.295 | 9    | 0.17          |
| Average value | 0.161 |      | 0.251 |      | 0.305 |      | 0.369 |      | 0.506 |      |               |

According to the evaluation results of the comprehensive level of tourism development in the Guangdong-Hong Kong-Macao Greater Bay Area: firstly, from the time trend, the level of tourism development in the Guangdong-Hong Kong-Macao Greater Bay Area is steadily increasing, as can be seen from the average value of each city, which steadily increased from 0.161 in 2011 to 0.506 in 2019, which is by a relatively large jump. In 9 years, the level of tourism development has risen 2.14 times, achieving ultra-high-speed development, indicating that the strength of tourism development in the Guangdong-Hong Kong-Macao Greater Bay Area has been increasing, followed by relying on its own advantages, making full use of the characteristic tourism resources, deepening the transformation and upgrading of the tourism industry, and bringing into play the potential of the special circle of tourism economy in the Greater Bay Area.

Secondly, in terms of spatial distribution, the development within the Guangdong-Hong Kong-Macao Greater Bay Area is uneven, and there is an obvious stratification in the level of tourism development among the cities [5]. From the comprehensive degree, the tourism development of four cities, Hong Kong, Macau, Guangzhou and Shenzhen, is more prominent, occupying

the top four positions for a long time, compared with the remaining seven cities, there is a significant gap. Among them, the comprehensive level of tourism development strength of Hong Kong tourism industry is leading across the board, the tourism development level industry continues to rapidly improve, 2011-2019 improved by more than 1.41 times for 0.5626. Hong Kong, as a rare exhibition tourism city in the Bay Area, has played a leading role in the concerted development of the region. Macau, Shenzhen and Guangzhou are three major cities with relatively good strength in the comprehensive level of tourism development, and the three cities constitute the trend of tripod.

### 3.2.2 Level of Regional Economic Development:

According to the comprehensive evaluation results of regional economic development, the Guangdong, Hong Kong and Macao Greater Bay Area shows a continuous and steady increase in the comprehensive level of economic development, which is also in line with the government's planned goals for the construction of the Greater Bay Area, and the economic development is in good shape. The cities in the Bay Area have complementary advantages and work together to promote regional economic development.

**TABLE II.** REGIONAL ECONOMIC DEVELOPMENT LEVEL AND RANKING OF GUANGDONG, HONG KONG AND MACAO GREATER BAY AREA, 2011-2019

| City      | 2011  | Rank | 2013  | Rank | 2015  | Rank | 2017  | Rank | 2019  | Rank | Average value |
|-----------|-------|------|-------|------|-------|------|-------|------|-------|------|---------------|
| Hong Kong | 0.621 | 1    | 0.656 | 1    | 0.663 | 1    | 0.674 | 1    | 0.669 | 1    | 0.657         |
| Macau     | 0.408 | 2    | 0.451 | 2    | 0.468 | 2    | 0.533 | 2    | 0.528 | 2    | 0.478         |
| Guangzhou | 0.273 | 5    | 0.319 | 5    | 0.325 | 5    | 0.366 | 4    | 0.385 | 3    | 0.334         |

|               |       |    |       |    |       |    |       |    |       |    |       |
|---------------|-------|----|-------|----|-------|----|-------|----|-------|----|-------|
| Shenzhen      | 0.326 | 4  | 0.356 | 3  | 0.362 | 3  | 0.372 | 3  | 0.371 | 5  | 0.357 |
| Zhuhai        | 0.350 | 3  | 0.351 | 4  | 0.341 | 4  | 0.352 | 5  | 0.376 | 4  | 0.354 |
| Foshan        | 0.146 | 9  | 0.172 | 9  | 0.174 | 9  | 0.193 | 9  | 0.206 | 9  | 0.178 |
| Huizhou       | 0.149 | 8  | 0.192 | 7  | 0.242 | 6  | 0.251 | 7  | 0.248 | 7  | 0.216 |
| Dongguan      | 0.203 | 6  | 0.223 | 6  | 0.241 | 7  | 0.263 | 6  | 0.277 | 6  | 0.241 |
| Zhongshan     | 0.181 | 7  | 0.191 | 8  | 0.208 | 8  | 0.215 | 8  | 0.242 | 8  | 0.207 |
| Jiangmen      | 0.121 | 11 | 0.169 | 10 | 0.145 | 11 | 0.182 | 10 | 0.195 | 11 | 0.162 |
| Zhaoqing      | 0.127 | 10 | 0.136 | 11 | 0.152 | 10 | 0.173 | 11 | 0.201 | 10 | 0.158 |
| Average value | 0.264 |    | 0.292 |    | 0.302 |    | 0.325 |    | 0.336 |    |       |

From the perspective of cities, there is a large gap in the regional economic development of Guangdong, Hong Kong and Macau in the Greater Bay Area. Among the 11 cities, Hong Kong ranks first and has obvious advantages in regional economic development; Macau follows with the second highest level of economic development; Shenzhen and Guangzhou are the two cities catching up.

The Hong Kong and Macao regions have the basic advantages of economic development due to their unique superior socio-economic foundation, high degree of openness, strong financial strength of local governments, relatively perfect social welfare system and the establishment of ecological protection system; while the PRD region is more fragmented in development, with the three cities of Guangzhou, Shenzhen and Zhuhai developing rapidly and significantly better than other cities such as Dongguan and Jiangmen [6]. Therefore, the State Council proposed in the Outline of the Guangdong-Hong Kong-Macao Greater Bay Area Development Plan 2021 to position the four central cities of Hong Kong, Macau, Guangzhou, and Shenzhen as the core engines of regional development in the Guangdong-Hong Kong-Macao Greater Bay Area.

In general, the change in economic development ranking among cities is much smaller than the comprehensive tourism development index, with Hong

Kong and Macao always occupying the top two positions, and Shenzhen also jumping to the third position in 2013, but slipping to the 5th in 2017-2019. Jiangmen, Huizhou, and Zhuhai have each jumped one position in recent years, which also shows that the competition for economic development within the Bay Area is still fierce, but some cities' economic development level still has more room for development.

#### 4. ANALYSIS OF THE COUPLING COORDINATION DEGREE BETWEEN TOURISM AND URBAN ECONOMIC DEVELOPMENT

##### 4.1 The overall characteristics of coupling coordination in Guangdong-Hong Kong-Macao Greater Bay Area

This paper measures the coupling coordination between tourism and urban economic development from 2009-2019 using data from a total of 11 cities in the Guangdong-Hong Kong-Macao Greater Bay Area, thus obtaining the mean value of coupling and the mean value of coupling coordination for each year, and the results are shown in Table 3.

**TABLE III.** AVERAGE VALUE OF COUPLING AND COORDINATION BETWEEN TOURISM AND URBAN ECONOMIC DEVELOPMENT IN GUANGDONG, HONG KONG AND MACAO GREATER BAY AREA, 2010-2019

| Year | Mean value of coupling degree | Mean value of coupling coordination degree | Coupling coordination stage |
|------|-------------------------------|--|-----------------------------|
| 2010 | 0.936                         | 0.372                                      | 4                           |
| 2011 | 0.941                         | 0.380                                      | 4                           |
| 2012 | 0.943                         | 0.412                                      | 5                           |
| 2013 | 0.948                         | 0.406                                      | 4                           |
| 2014 | 0.952                         | 0.425                                      | 5                           |
| 2015 | 0.959                         | 0.435                                      | 5                           |

|      |       |       |   |
|------|-------|-------|---|
| 2016 | 0.987 | 0.489 | 5 |
| 2017 | 0.957 | 0.501 | 6 |
| 2018 | 0.952 | 0.518 | 6 |
| 2019 | 0.950 | 0.525 | 6 |

As can be seen from Table 3, the mean value of coupling degree between tourism and urban economic development in Guangdong, Hong Kong and Macao Greater Bay Area from 2010 to 2019, and the mean value of coupling coordination degree shows a more stable growth. In the coupling degree mean value, it is 0.956 in 2019, an increase of 7.05% compared with 0.893 in 2010, indicating that the tourism industry is increasingly linked with urban economic development, which is consistent with the consistent economic principle.

In terms of the mean value of coupling coordination, it was 0.335 in 2010, which was in a mild disorder, and then the mean value of coupling coordination roughly showed a continuous upward trend to 0.573 in 2019, which was in a barely coordinated stage, which also indicates that there is still a gap between tourism and urban economic development in the Guangdong-Hong Kong-Macao Greater Bay Area and quality coordination.

From a local perspective, the mean value of coupling coordination in 2012 was 0.412, which was in a state of near dissonance, and then there was a brief decline to a mild dissonance of 0.398 in 2013, followed by a continuous increase and in a state of near dissonance in 2014-2016, and entered a state of barely coordinated and

maintained in 2017, we can infer that the years 2012-2016 are the excessive stage of disorder-coordination.

From a general point of view, in recent years, the development of tourism in the Guangdong-Hong Kong-Macao Greater Bay Area has also driven the development of urban economy within the Bay Area, and at the same time, the development of urban economy within the Bay Area has also driven the development of tourism, and the two complement each other and develop together, making the development of tourism and urban economic development within the Bay Area gradually move towards a high-quality coordinated development pattern [7].

#### ***4.2 Overview of the coupled and coordinated development among cities***

In order to be able to examine more intuitively the coupling status and type of development between tourism development and urban economic development of each city in the Bay Area, Table 4 indicates the coupling coordination between tourism and urban economic development of 11 cities in the Guangdong-Hong Kong-Macao Greater Bay Area.

**TABLE IV.** THE COUPLING AND COORDINATION OF TOURISM DEVELOPMENT AND URBAN ECONOMIC DEVELOPMENT IN 11 CITIES OF GUANGDONG-HONG KONG-MACAO GREATER BAY AREA

| City      | 2011  |     | 2013  |     | 2015  |     | 2017  |     | 2019  |     |
|-----------|-------|-----|-------|-----|-------|-----|-------|-----|-------|-----|
|           | CCD   | CCS |
| Hong Kong | 0.572 | 6   | 0.591 | 6   | 0.596 | 6   | 0.664 | 7   | 0.692 | 7   |
| Macao     | 0.483 | 5   | 0.587 | 6   | 0.591 | 6   | 0.648 | 7   | 0.689 | 7   |
| Guangzhou | 0.517 | 6   | 0.541 | 6   | 0.568 | 6   | 0.625 | 7   | 0.667 | 7   |
| Shenzhen  | 0.431 | 5   | 0.441 | 5   | 0.498 | 5   | 0.565 | 6   | 0.591 | 6   |
| Zhuhai    | 0.329 | 4   | 0.366 | 4   | 0.419 | 5   | 0.529 | 6   | 0.583 | 6   |
| Foshan    | 0.312 | 4   | 0.327 | 4   | 0.348 | 4   | 0.459 | 5   | 0.481 | 5   |
| Hui zhou  | 0.328 | 4   | 0.352 | 4   | 0.392 | 4   | 0.487 | 5   | 0.491 | 5   |
| Dong      | 0.431 | 5   | 0.437 | 5   | 0.442 | 5   | 0.498 | 5   | 0.499 | 5   |

|               |       |   |       |   |       |   |       |   |       |   |
|---------------|-------|---|-------|---|-------|---|-------|---|-------|---|
| guan          |       |   |       |   |       |   |       |   |       |   |
| Zhong<br>shan | 0.304 | 4 | 0.327 | 4 | 0.387 | 4 | 0.441 | 5 | 0.451 | 5 |
| Jian<br>gmen  | 0.201 | 3 | 0.218 | 3 | 0.259 | 3 | 0.291 | 3 | 0.314 | 4 |
| Zhao<br>qing  | 0.274 | 3 | 0.288 | 3 | 0.294 | 3 | 0.304 | 4 | 0.312 | 4 |

From the above table we can see that the coupling coordination of cities see from 2011-2019 shows a continuous growth, which also shows that the tourism and economic development among cities have achieved better results, thanks to the opening of the Hong Kong-Zhuhai-Macao Bridge and the construction of the Zhuhai-Huangqin Free Trade Zone, etc. Zhuhai, in particular, has achieved a leap from mild dissonance to barely coordinated, which also reflects the "Guangdong-Hong Kong-Macao Greater Bay Area Development This also reflects the "Outline of the Plan for the Development of the Guangdong-Hong Kong-Macao Greater Bay Area", which proposes to "actively expand cooperation in tourism and other fields in the Guangdong-Hong Kong-Macao Greater Bay Area, and jointly create a quality living area with high quality public services and pleasant living and tourism".

Looking at the four central cities, the coupling and coordination of each city has increased continuously from 2011 to 2019, which also shows that tourism and urban economic development have achieved remarkable results. However, we can see from the above chart that Hong Kong's growth has gradually slowed down in recent years, while Macau, as the "Top 10 Best Tourism Regions" where Chinese and Portuguese cultures meet, has made every effort to develop non-gaming elements in recent years, and the coupling coordination has increased significantly from the verge of disorder to the state of primary coordination. As economic centers, Guangzhou and Shenzhen are well-equipped with urban support facilities, and the development of tourism facilities along the coastline is relatively complete, attracting a large number of tourists from home and abroad.

Zhuhai is close to the Macao SAR, and with the completion of the Hong Kong-Zhuhai-Macao Bridge, Zhuhai, as a demonstration area of Guangdong Province for all-area tourism, actively promotes tourism and cultural industries. In terms of the degree of coupling, its coordination has improved in the brightness stage, from mildly dysfunctional to barely coordinated. In 2019, only Jiangmen, Zhaoqing, both of which have a lower coupling thin strip, remains in a state of mild dissonance.

## 5. CONCLUSION

Coordinating tourism development with economic development is both a key to the development of the Greater Bay Area and, to some extent, a reflection of the growing standard of living of the country's residents and the modernization of the government's ability to govern. Through the systematic analysis of this paper, the following conclusions are drawn: (1) From 2010 to 2019, the level of tourism and urban economic development in the Guangdong-Hong Kong-Macao Greater Bay Area has continued to improve, with the comprehensive level of tourism development growing from 0.14 to 0.495, and the average value of urban economic development water having risen from 0.312 to 0.35, with both systems showing a gradual upward trend. (2) from the spatial distribution, the development of the cities among the distribution is more uneven, Hong Kong, Macau, Guangzhou, Shenzhen four places of tourism and economic development are in the lead, but the local cities such as Zhongshan, Jiangmen two places of tourism development and strength is relatively weak.

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