

Research on Tourism Efficiency and Spatial Differences in the Guangdong, Hongkong, Macau and Greater Bay Area – Taking 21 Cities in Guangdong Province as Examples

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Abstract: The Guangdong-Hong Kong-Macau and Greater Bay Area is an important area for the development of international tourism. First, the current status of tourism development in Guangdong Province is described. Then, based on the input-oriented DEA method, MAXDEA software is applied to conduct tourism efficiency research on the tourism data of 21 cities in Guangdong Province in 2017. After calculation, it is concluded that the regional tourism development of 21 cities in Guangdong Province is unbalanced, and some cities need to improve the quality of tourism services and expand production capacity as well as invest more human, material and financial resources to develop tourism. Then, based on the calculated tourism efficiency, the natural discontinuous method (Jenks) in Arcgis is used to plot the spatial difference in tourism efficiency between 21 cities in Guangdong Province in 2011 and 2017, and a comparative analysis is made. Finally, it puts forward suggestions to promote tourism development in Guangdong Province and the entire Guangdong-Hong Kong-Macau and Greater Bay Area.

1. Introduction

The Guangdong-Hong Kong-Macau Greater Bay Area is committed to building a world-class Greater Bay Area and achieving tourism internationalization. Under the background of the Belt and Road Initiative, the development of tourism in the Guangdong-Hong Kong-Macau Greater Bay Area will become a hot topic in the future development of regional economics. Kaijun Wu (2019) discusses how to enhance the competitive advantage of tourism in the Guangdong-Hong Kong-Macau Greater Bay Area; Yuyu Zhang(2018) uses Foshan City, Guangdong Province as an example to analyze the model of rural ecotourism innovation; Xiaohui Huang and Kaimin Zou (2016) discuss the Greater Bay Area How to improve the development strategy of cultural, business and tourism under the background of building a world-class tourist destination. At present, there is not much research literature on tourism development in the Guangdong-Hong Kong-Macau Greater Bay Area. Most of

them use qualitative methods. Only a few literatures use quantitative research methods, and few literatures use spatial econometric analysis methods. This study takes 21 cities in Guangdong Province as cases, uses quantitative analysis methods to calculate their tourism efficiencies, and adds spatial measurement analysis methods to research their tourism spatial differences distribution in depth.

2. Current Situation of Tourism Development in Guangdong Province

The tourism development status of 21 cities in Guangdong Province in 2018 is shown in Table 1. The number of overnight tourists (10,000 people), the number of outbound tourists organized by travel agencies (persons), tourism revenue (100 million yuan), and international tourism foreign exchange income (ten thousand US dollars) Four indicators measure the current status of tourism development in Guangdong Province.

Table 1: Tourism Development Status of 21 Cities in Guangdong Province in 2018.

Areas	overnight tourists (10,000 people)	the number of outbound tourists organized by travel agencies (persons)	tourism revenue (100 million yuan)	international tourism foreign exchange income (ten thousand US dollars)
Guangzhou	6532.55	3056786.00	4008.19	648214.18
Shenzhen	6404.99	4448820.00	1609.31	512093.94
Zhuhai	2452.62	604429.00	466.16	146829.97
Shantou	2164.43	80821.00	534.47	19874.12
Foshan	1695.31	1427905.00	809.14	161095.78
Shaoguan	1832.26	9343.00	453.02	2390.92
Heyuan	1728.16	1129.00	316.82	2240.35
Meizhou	2223.27	12197.00	504.31	17471.41
Huizhou	2693.32	50413.00	500.36	104290.74
Shanwei	928.15	981.00	161.89	3389.94
Dongguan	2186.46	146616.00	529.37	163011.64
Zhongshan	1412.18	217912.00	294.10	27227.26
Jiangmen	2709.62	166370.00	586.84	135315.47
Yangjiang	1478.86	7385.00	307.83	4293.49
Zhanjiang	2639.41	12875.00	510.89	11724.29
Maoming	1398.54	14530.00	425.85	2815.43
Zhaoqing	1371.22	57176.00	322.99	36151.57
Qingyuan	1292.68	25651.00	346.21	10167.58
Chaozhou	2007.23	9739.00	306.35	34744.57
Jieyang	2189.74	1554.00	330.09	2557.46
Yunfu	1659.84	1609.00	286.47	5279.76

Data source: Guangdong county-city statistical database-annual data (city level)

It can be seen from Table 1 that the ranking of the number of overnight tourists (ten thousand person-times) received by 21 cities in Guangdong Province in 2018 is:

Guangzhou>Shenzhen>Jiangmen>Huizhou>Zhanjiang>Zhuhai>Meizhou>Jieyang>Dongguan>Shantou>Chaozhou>Shaoguan>Heyuan>Foshan>Yunfu>Yangjiang>Zhongshan>Maoming>Zhaoqing>Qingyuan>Shanwei, while the number of overnight tourists in Guangzhou are about 7.03 times that of Shanwei.

In 2018, the ranking of the number of outbound tourists (persons) of 21 cities in Guangdong Province is:

Shenzhen>Guangzhou>Foshan>Zhuhai>Zhongshan>Jiangmen>Dongguan>Shantou>Zhaoqing>Huizhou>Qingyuan>Maoming>Zhanjiang>Meizhou>Chaozhou>Shaoguan>Yangjiang>Yunfu>Jieyang>Heyuan>Shanwei, and the number of outbound tourists from Shenzhen Travel Agency groups are about 4.53 times that of Shanwei.

The ranking of the tourism revenue (100 million yuan) of 21 cities in Guangdong Province in 2018 is:

Guangzhou>Shenzhen>Foshan>Jiangmen>Shantou>Dongguan>Zhanjiang>Meizhou>Huizhou>Zhuhai>Shaoguan>Maoming>Qingyuan>Jieyang>Zhaoqing>Heyuan>Yangjiang>Chaozhou>Zhongshan>Yunfu>Shanwei, and the tourism income of Guangzhou are about 24.76 times that of Shanwei.

The ranking of the international tourism foreign exchange income (ten thousand dollars) of 21 cities in Guangdong Province in 2018 is:

Guangzhou>Shenzhen>Dongguan>Foshan>Zhuhai>Jiangmen>Huizhou>Zhaoqing>Chaozhou>Zhongshan>Shantou>Meizhou>Zhanjiang>Qingyuan>Yunfu>Yangjiang>Shanwei>Maoming>Jieyang>Shaoguan>Heyuan, and the foreign exchange income of Guangzhou International Tourism are about 289.34 times that of Heyuan.

3. Research Area, Data Sources, Research Methods

3.1. Research Area

Guangdong Province covers 21 cities: Guangzhou, Shenzhen, Zhuhai, Shantou, Foshan, Shaoguan, Heyuan, Meizhou, Huizhou, Shanwei, Dongguan, Zhongshan, Jiangmen, Yangjiang, Zhanjiang, Maoming, Zhaoqing, Qingyuan, Chaozhou, Jieyang, Yunfu.

3.2. Data Sources

The data is taken from "Guangdong County and City Statistical Database-Annual Data (City Level)" (2011-2017). Due to the lack of some indicators in some years in the statistical database-annual data (municipal level) of Guangdong counties and cities, and carefully considered and considered the timeliness, so the data from 2011 to 2017 for analysis are selected.

Table 2: Evaluation System of Regional Tourism Efficiency Index of 21 Cities in Guangdong Province.

Areas	Input indicators		Output indicators	
	Investment in fixed assets (100 million yuan)	Number of employed persons at the end of the year (ten thousand people)	Number of overnight tourists (10,000 people)	International tourism foreign exchange income (ten thousand US dollars)

3.3. Research Methods

3.3.1. DEA Analysis Method

C²R and BC² are the two most commonly used models to measure the efficiency of DEA.

The C²R model is as follows (θ is the overall efficiency value of each DMU)

$$\left\{ \begin{array}{l} \min \theta \\ \sum_{j=1}^n \lambda_j x_j + S^- = \theta x_0 \\ \sum_{j=1}^n \lambda_j y_j + S^+ = y_0 \\ S^- \geq 0, S^+ \geq 0, \lambda_j \geq 0 \\ \theta \text{ is Unconstrained, } j = 1, 2, \dots, n \end{array} \right. \quad (1)$$

The mathematical expression of BC² is as follows (η is the pure technical efficiency value of each DMU):

$$\left\{ \begin{array}{l} \text{Min } \eta \\ \sum_{j=1}^n \lambda_j x_j + S^- = \eta x_0 \\ \sum_{j=1}^n \lambda_j y_j + S^+ = y_0 \\ S^- \geq 0, S^+ \geq 0, \lambda_j \geq 0 \\ \sum_{j=1}^n \lambda_j, j = 1, 2, \dots, n \end{array} \right. \quad (2)$$

3.3.2. Natural Discontinuity Method (Jenks)

The statistics of spatial autocorrelation are varied. In this study, Arcgis' natural discontinuity method (Jenks) was used to grade the tourism efficiency of 21 cities in Guangdong Province.

4. Analysis of Regional Tourism Efficiency

4.1. Regional Tourism Efficiency of 21 Cities in Guangdong Province

Using MaxDEA, the tourism Technical Efficiency TE of 21 cities in Guangdong Province from 2011 to 2017 is calculated, which is decomposed into tourism Pure Technical Efficiency PTE and tourism Scale Efficiency SE, and the results are accurate to three digits. For details, these can be seen in Table 3, 4, 5.

Table 3: Technical Efficiency TE of 21 cities in Guangdong Province from 2011 to 2017.

Areas	2011	2012	2013	2014	2015	2016	2017
Guangzhou	0.831	0.958	1.000	1.000	1.000	1.000	1.000
Shenzhen	1.000	1.000	1.000	1.000	1.000	1.000	0.946
Zhuhai	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Shantou	0.687	0.619	0.603	0.610	0.578	0.513	0.503

Foshan	0.292	0.393	0.442	0.446	0.441	0.415	0.404
Shaoguan	0.734	0.765	0.839	0.837	0.911	0.882	0.885
Heyuan	0.836	0.930	0.929	0.899	0.901	0.822	0.817
Meizhou	1.000	1.000	1.000	1.000	1.000	1.000	0.809
Huizhou	0.452	0.487	0.572	0.582	0.588	0.584	0.604
Shanwei	0.493	0.532	0.562	0.610	0.612	0.550	0.522
Dongguan	0.591	0.673	0.628	0.664	0.765	0.888	0.937
Zhongshan	0.336	0.388	0.429	0.527	0.474	0.468	0.458
Jiangmen	0.578	0.666	0.728	0.773	0.776	0.816	0.839
Yangjiang	0.427	0.494	0.568	0.681	0.761	0.932	0.820
Zhanjiang	0.588	0.675	0.604	0.606	0.593	0.526	0.503
Maoming	0.444	0.270	0.220	0.254	0.286	0.277	0.296
Zhaoqing	0.676	0.691	0.677	0.503	0.453	0.453	0.417
Qingyuan	0.575	0.662	0.631	0.664	0.668	0.701	0.584
Chaozhou	0.745	0.795	0.808	0.959	1.000	1.000	1.000
Jieyang	0.238	0.292	0.386	0.472	0.511	0.515	0.508
Yunfu	0.623	0.745	0.810	0.873	0.885	1.000	0.887
Mean	0.626	0.668	0.687	0.712	0.724	0.731	0.702

Table 4: Pure Technical Efficiency PTE in 21 cities of Guangdong Province, 2011-2017.

Areas	2011	2012	2013	2014	2015	2016	2017
Guangzhou	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Shenzhen	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Zhuhai	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Shantou	0.706	0.635	0.620	0.625	0.588	0.521	0.508
Foshan	0.305	0.410	0.471	0.486	0.477	0.466	0.430
Shaoguan	0.847	0.856	0.869	0.873	0.934	0.900	0.919
Heyuan	1.000	1.000	1.000	0.972	0.938	0.894	0.868
Meizhou	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Huizhou	0.465	0.495	0.579	0.585	0.588	0.586	0.733
Shanwei	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Dongguan	0.680	0.682	0.652	0.744	0.844	0.976	0.981
Zhongshan	0.549	0.553	0.565	0.636	0.573	0.569	0.573
Jiangmen	0.584	0.682	0.750	0.779	0.790	0.834	0.850
Yangjiang	0.859	0.893	0.910	0.919	0.930	0.983	0.961
Zhanjiang	0.598	0.755	0.637	0.629	0.614	0.586	0.688
Maoming	0.921	0.524	0.457	0.444	0.434	0.435	0.429
Zhaoqing	0.681	0.701	0.684	0.550	0.542	0.543	0.542
Qingyuan	0.652	0.722	0.705	0.708	0.686	0.740	0.751
Chaozhou	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Jieyang	0.453	0.469	0.467	0.496	0.520	0.528	0.572
Yunfu	0.928	0.933	0.909	0.911	0.908	1.000	0.920
Mean	0.773	0.777	0.775	0.779	0.779	0.789	0.796

Table 5: Scale Efficiency SE of 21 cities in Guangdong Province, 2011-2017.

Areas	2011	2012	2013	2014	2015	2016	2017
Guangzhou	0.831	0.958	1.000	1.000	1.000	1.000	1.000
Shenzhen	1.000	1.000	1.000	1.000	1.000	1.000	0.946
Zhuhai	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Shantou	0.972	0.975	0.973	0.975	0.983	0.985	0.990
Foshan	0.958	0.956	0.938	0.918	0.923	0.891	0.939
Shaoguan	0.866	0.893	0.965	0.959	0.975	0.979	0.963
Heyuan	0.836	0.930	0.929	0.925	0.960	0.919	0.941
Meizhou	1.000	1.000	1.000	1.000	1.000	1.000	0.809
Huizhou	0.973	0.984	0.988	0.995	0.998	0.996	0.824
Shanwei	0.493	0.532	0.562	0.610	0.612	0.550	0.522
Dongguan	0.868	0.986	0.964	0.893	0.906	0.909	0.954
Zhongshan	0.611	0.700	0.758	0.829	0.827	0.822	0.799
Jiangmen	0.990	0.975	0.970	0.993	0.981	0.978	0.986
Yangjiang	0.497	0.553	0.624	0.741	0.818	0.948	0.853
Zhanjiang	0.982	0.894	0.948	0.963	0.965	0.898	0.731
Maoming	0.482	0.515	0.482	0.572	0.659	0.637	0.690
Zhaoqing	0.992	0.986	0.990	0.913	0.836	0.834	0.769
Qingyuan	0.882	0.916	0.894	0.937	0.973	0.946	0.776
Chaozhou	0.745	0.795	0.808	0.959	1.000	1.000	1.000
Jieyang	0.526	0.623	0.826	0.951	0.982	0.975	0.888
Yunfu	0.671	0.799	0.891	0.958	0.974	1.000	0.963
Mean	0.818	0.856	0.881	0.909	0.922	0.917	0.873

The calculation results show that the regional tourism efficiency of 21 cities in Guangdong Province has the following characteristics:

4.2. Analysis on the Results of Regional Tourism Efficiency

The average Technical Efficiency of regional tourism in 21 cities in Guangdong Province from 2011 to 2017 is: 0.626, 0.668, 0.687, 0.712, 0.724, 0.731, 0.702. Among them, In 2011, the Technical Efficiency of tourism in the three cities of Shenzhen, Zhuhai and Meizhou has reached the optimal level. In 2017, the Technical Efficiency of tourism in 21 cities of Guangdong Province has reached the optimal level: Guangzhou, Zhuhai and Chaozhou. Overall, the overall Technical Efficiency of regional tourism in Guangdong Province is on the rise.

The Pure Technical Efficiency of tourism in Guangdong is higher than Technical Efficiency. From 2011 to 2017, the average Pure Technical Efficiency of tourism in Guangdong Province is 0.773, 0.777, 0.775, 0.779, 0.779, 0.789, 0.796, which is slightly higher than the Technical Efficiency. In 2011, the Pure Technical Efficiency of tourism in Guangdong has reached the optimal level is: Guangzhou, Shenzhen, Zhuhai, Heyuan, Meizhou, Shanwei, Chaozhou. In 2017, the Pure Technical Efficiency of tourism in Guangdong has reached the optimal level is: Guangzhou, Shenzhen, Zhuhai, Meizhou, Shanwei, Chaozhou. There is no obvious change in the urban pattern.

The Scale Efficiency of tourism in Guangdong is higher than Pure Technical Efficiency and Technical Efficiency. The Scale Efficiency has reached more than 80% of the optimal level. The

average Scale Efficiency of tourism in Guangdong Province from 2011 to 2017 is: 0.818, 0.856, 0.881, 0.909, 0.922, 0.917, 0.873. The cities with the best Scale Efficiency of tourism in 2011 are: Shenzhen, Zhuhai, Meizhou. The cities with the best Scale Efficiency of tourism in 2017 are: Guangzhou, Zhuhai and Chaozhou.

4.3. Significant Differences in Regional Tourism Efficiency among 21 Cities in Guangdong Province

From 2011 to 2017, the Technical Efficiency, Pure Technical Efficiency, and Scale Efficiency of Guangzhou, Shenzhen, and Zhuhai all remained at high levels, indicating that these cities have high utilization of tourism inputs. Compared with 2011 and 2017, the Technical Efficiency of Guangzhou, Shaoguan, Dongguan, Jiangmen, Yangjiang, Chaozhou and Yunfu all increased significantly, while the Technical Efficiency of Shantou, Heyuan, Zhanjiang, Maoming and Zhaoqing decreased significantly. The Pure Technical Efficiency of Shaoguan, Huizhou, Dongguan, Jiangmen, and Yangjiang are all increasing, while the Pure Technical Efficiency of Shantou, Maoming, and Zhaoqing are all decreasing, the reduction of Technical Efficiency means that the quality of tourism services needs to be improved to attract tourists. The Scale Efficiency of Guangzhou, Shantou, Shaoguan, Heyuan, Dongguan, Yangjiang, Chaozhou, Jieyang, and Yunfu has increased significantly, while the Scale Efficiency of Huizhou, Zhanjiang, Zhaoqing, and Qingyuan has decreased significantly, the low Scale Efficiency means that these cities need to expand production capacity and invest more human, material and financial resources to develop tourism.

5. Spatial Differences in Tourism Efficiency

5.1. Spatial Differences in Tourism Technical Efficiency

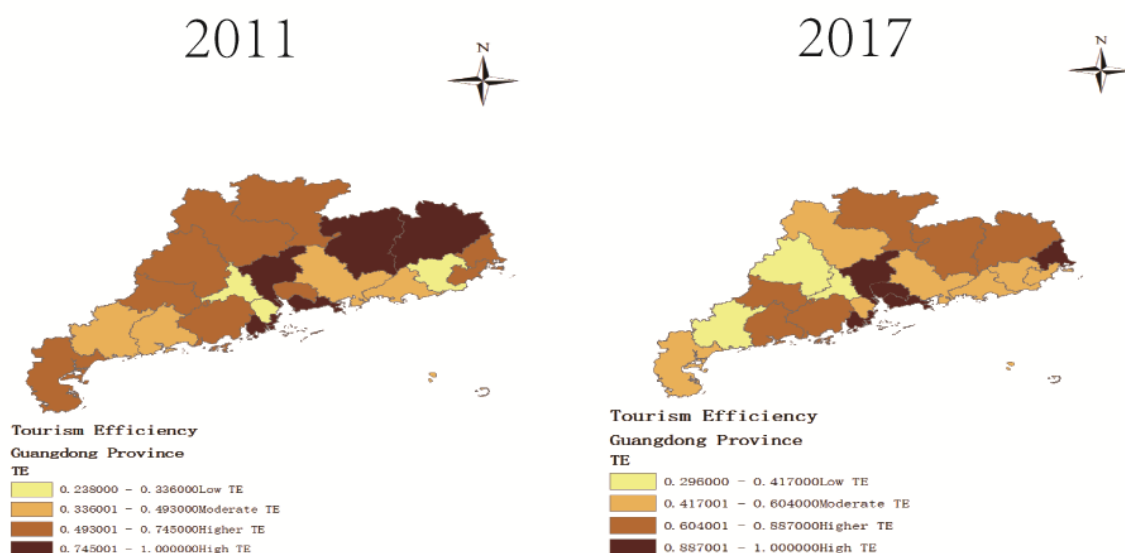


Figure 1: Spatial difference of tourism Technical Efficiency between 21 cities in Guangdong Province in 2011 and 2017.

It can be drawn from Figure 1, In 2011, the cities with the highest tourism Technical Efficiency are Guangzhou, Shenzhen, Zhuhai, Heyuan, and Meizhou (0.745001-1.000000). The cities with higher

tourism Technical Efficiency are Zhanjiang and Yunfu City, Zhaoqing City, Qingyuan City, Shaoguan City, Jiangmen City, Dongguan City, Shantou City, Chaozhou City (0.493001-0.745000). The cities with medium tourism Technical Efficiency are Huizhou City, Shanwei City, Maoming City, Yangjiang City (0.336001- 0.493000). The cities with the lowest tourism Technical Efficiency are Foshan, Zhongshan, Jieyang (0.238000-0.336000). In 2017, The cities with the highest tourism Technical Efficiency are Guangzhou, Shenzhen, Dongguan, Zhuhai, and Chaozhou (0.887001-1.000000). The cities with higher tourism Technical Efficiency are Shaoguan, Heyuan, Meizhou, Yunfu , Yangjiang City, Jiangmen City (0.604001-0.887000). The cities with medium tourism Technical Efficiency are Zhanjiang City, Qingyuan City, Huizhou City, Shanwei City, Jieyang City, Shantou City, Zhongshan City (0.417001-0.604000). The cities with lowest tourism Technical Efficiency are: Zhaoqing City, Foshan City, Maoming City (0.296000-0.417000).

5.2. Spatial Differences in Tourism Pure Technical Efficiency

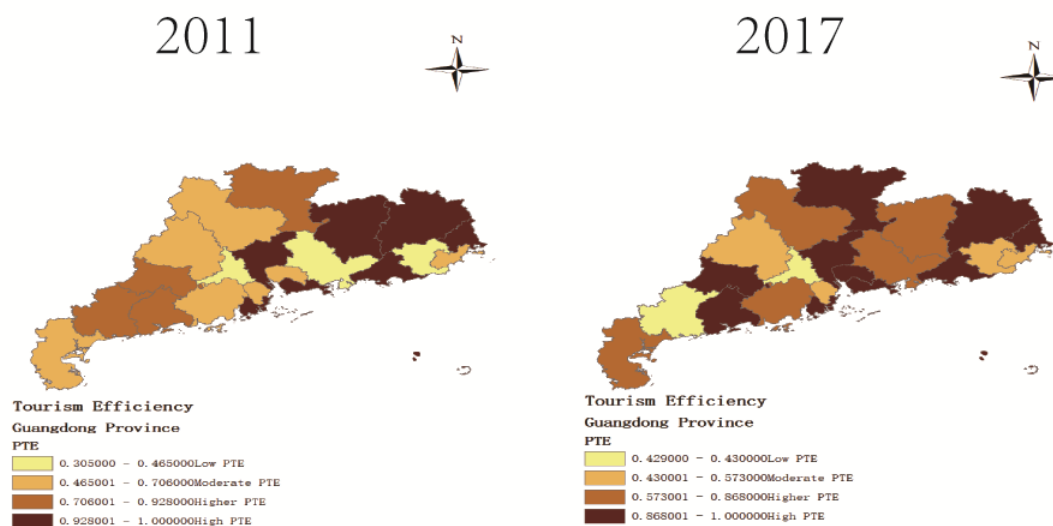


Figure 2: Spatial difference in Pure Technical Efficiency of tourism between 21 cities in Guangdong Province in 2011 and 2017

It can be seen from Figure 2 , In 2011 the cities with the highest pure tourism technical efficiency are Guangzhou, Zhuhai, Shenzhen, Heyuan, Meizhou, Chaozhou, and Shanwei (0.928001-1.000000). The cities with higher pure tourism technical efficiency are Yunfu City, Yangjiang City, Maoming City (0.706001-0.928000). The cities with medium tourism pure technical efficiency are Zhanjiang City, Zhaoqing City, Qingyuan City, Jiangmen City, Zhongshan City, Dongguan City, Shantou City (0.465001-0.706000).The cities with the lowest tourism pure technical efficiency are Foshan, Huizhou, Jieyang (0.305000-0.465000).

In 2017,The cities with the highest tourism pure technical efficiency in are Shaoguan City, Guangzhou City, Dongguan City, Shenzhen City, Zhuhai City, Meizhou City, Chaozhou City, Shanwei City, Yunfu City, Yangjiang City (0.868001-1.000000).The cities with higher pure tourism technical efficiency are Zhanjiang City, Jiangmen City, Qingyuan City, Heyuan City, Huizhou City (0.573001-0.868000).The cities with medium tourism pure technical efficiency are Zhaoqing City, Zhongshan City, Jieyang City, Shantou City (0.430001-0.573000).The cities with the lowest pure technical efficiency of tourism are Maoming City and Foshan City (0.429000-0.430000).

5.3. Spatial Difference in Tourism Scale Efficiency

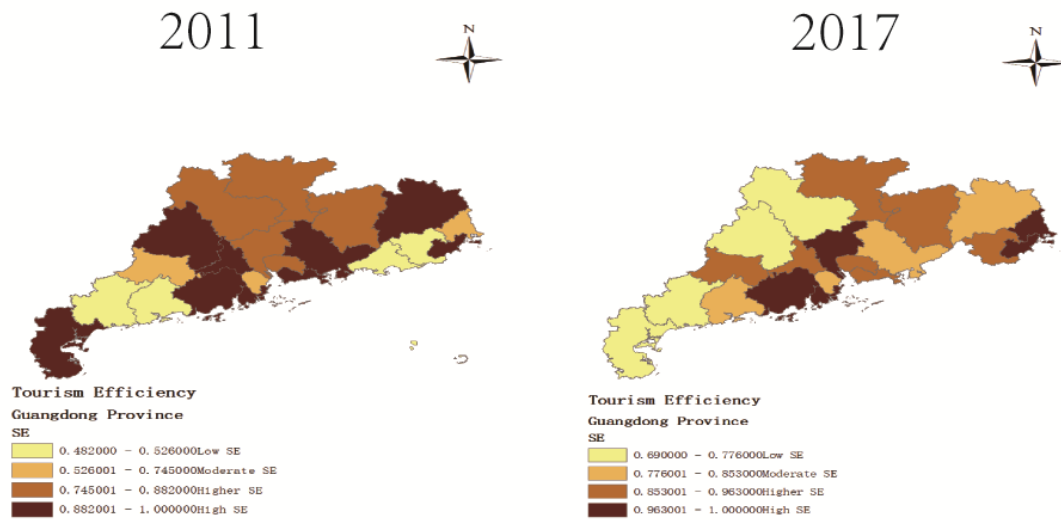


Figure 3: Spatial difference of tourism scale efficiency between 21 cities in Guangdong Province in 2011 and 2017.

In 2011, The cities with the highest tourism scale efficiency are Zhanjiang, Zhaoqing, Foshan, Jiangmen, Huizhou, Shenzhen, Meizhou, Shantou (0.882001-1.000000). The cities with higher tourism scale efficiency are Qingyuan, Shaoguan City, Heyuan City, Guangzhou City, Dongguan City (0.745001-0.882000). The cities with medium tourism scale efficiency are Yunfu City, Zhongshan City, Chaozhou City (0.526001-0.745000). The cities with the lowest tourism scale efficiency are Maoming City, Yangjiang City, Shanwei City, Jieyang City (0.482000-0.526000).

In 2017, The cities with the highest tourism scale efficiency are Jiangmen City, Guangzhou City, Chaozhou City, Shantou City (0.963001-1.000000). The cities with higher tourism scale efficiency are Yunfu City, Foshan City, Dongguan City, Shenzhen City, Shaoguan City, Heyuan City, Jieyang City (0.853001-0.963000). The cities with medium tourism scale efficiency are Yangjiang City, Zhongshan City, Huizhou City, Meizhou City (0.776001-0.853000). The cities with the lowest tourism scale efficiency are Zhanjiang City, Maoming City, Zhaoqing City, Qingyuan City, (0.690000-0.776000).

6. Conclusions

To sum up, Guangdong's tourism efficiency shows a trend of differentiation, and the spatial distribution also shows an uneven distribution law. Therefore, the regional tourism development gap in Guangdong Province should be narrowed. With Guangzhou and Shenzhen as the core, and the spatial distribution to surrounding prefecture-level cities should be expanded, to form a tourism concentration zone, relying on the proximity advantages of Hong Kong and Macau, actively develop cross-border tourism and realize the integration of tourism in the Guangdong-Hong Kong-Macau Greater Bay Area. At the same time, enhancing the convenience of transportation infrastructure and cross-border cooperation will help increase the capacity of cross-border tourism [1]. Finally, dig deeper into cultural tourism resources and improve the cultural appeal of the Guangdong-Hong Kong-Macau Greater Bay Area [2].

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