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## **Spatial coordination perspective of regional sustainable development: control of spatial difference in Guangdong-Guangxi Economic Zone**

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**Abstract:** Using the Exploratory Spatial Data Analysis (ESDA) method, this paper analyses the regional spatial difference of “Guangdong-Guangxi Economic Zone”. Through the coefficient of variation, it is found that the more developed regions and the less developed regions have a higher degree of agglomeration, which leads to the tendency of the overall spatial difference to enlarge. In terms of spatial distribution, the ‘high-high’ type of cities are mainly Guangzhou, Foshan and Zhongshan, which shows that these regions have a strong economic agglomeration and are closely connected with the surrounding areas, while the ‘low-low’ type of cities are mainly Wuzhou, etc., these cities are relatively undeveloped areas in the Guangdong-Guangxi Economic Zone, with less economic connection with the surrounding areas. The correlation between other types of areas and surrounding areas is not significant. The key to managing and controlling regional differences is to promote the coordinated development of Guangdong-Guangxi Economic Zone.

**Keywords:** spatial coordination; ‘1+9’ spatial pattern; Guangdong-Guangxi Economic Zone; differences in levels of economic development; control of spatial difference.

**Reference** to this paper should be made as follows: Wang, H. (2022) ‘Spatial coordination perspective of regional sustainable development: control of spatial difference in Guangdong-Guangxi Economic Zone’, *Int. J. Technology, Policy and Management*, Vol. 22, Nos. 1/2, pp.24–36.

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## **1 Introduction**

Scientific and reasonable spatial structure can not only promote the efficient use of regional resources, but also effectively avoid the urban diseases such as traffic congestion, housing shortage and resource scarcity, which is the ‘regulator’ and ‘booster’ of regional development (Cao et al., 2019). Promoting sustainable development and promoting regional spatial balance and coordination has become a core issue in regional policy-making, the top-level design and systematic research on the coordinated development of regions in the process of urbanisation in China is of great significance to the problem of uncoordinated regional development. In the past, we paid too much attention to the fair and reasonable distribution of wealth in time series, while ignoring the reality of disequilibrium and difference in spatial distribution. Therefore, the sustainable development of space is to reduce the economic difference between different space regions in a certain period, so that people in different space enjoy equal public services. For the research of regional sustainable development, the domestic and international research mostly starts from the construction of indicators to evaluate. The construction of sustainable evaluation index has been mature, and it has produced the United Nations Sustainable Development Index system and the national or regional sustainable development index system, which have important guidance function to regional sustainable development. However, the study of regional sustainable development from the perspective of analysing regional space is relatively few. Burchell, (2000) studied the role of expansionary and compact cities in promoting regional sustainable development. Fan and Scott (2003) pointed out that the excessively close relationships among cities in the region have a certain negative impact on sustainable development. However, in recent years, the biggest problem of regional development in China is not only the coordination among economy, society and Ecology, but also the uncoordinated problem that the gap of regional development level is widening. Due to the acceleration of industrialisation and urbanisation, the space area occupied by social and economic development is increasing rapidly, the human-land relationship is becoming more and more uncoordinated, and the regional development is gradually evolving towards imbalance, which is not conducive to the sustainable development of the region. At present, china’s regional overdevelopment and industrial development threaten the carrying capacity of resources and the environment, but with the emergence of empty cities and ghost towns in some regions, the loss of population, the desertification, and the imbalance in regional development have once again aroused people’s vigilance. These phenomena run counter to the sustainable development of regional space, which is also a difficult problem for the sustainable development of regional space Whether urban agglomerations, Economic Zones or urban continuous areas, rational development and appropriate protection based on regional functional positioning, effective promotion of spatial coordination of these regions, is the objective requirement of sustainable development.

The difference in regional economic development refers to the phenomenon that the overall level of economic development in the sense of per capita in different regions within a certain period is unequal (Qin, 1997). Over 30 years after the reform and opening up, China’s regional economic development has got remarkable achievements. However, the continuous expansion of regional economic difference in recent years has brought great challenge for China’s regional coordinated development and has aroused great concern from the government and academia. For the research on regional economic

differences, Chinese scholars focus on the aspects such as study of regional spatial difference patterns (Yang, 1994; Li and Qin, 2002; Li et al., 2008; Ying, 2003), study of regional spatial-temporal evolution (Lee, 2001; Wu, 2001), and trend prediction of regional development differences (Huang, 1996). In the terms of spatial scale, studies of large-scale regional spatial differences are changed into studies of small-scale spatial differences. Regional spatial differences at different levels are studied, and theoretical systems of regional development differences with Chinese characteristics are gradually formed, which have important theoretical significance for promoting regional coordinated and sustainable development. With the help of the research on regional difference theory, the methodology with certain value is formed in the practice of promoting regional coordinated development in China. The major realisations are, on the one hand, applying the research on regional development differences to clarify the mechanism for the formation of differences, to help adopt scientific regulatory measures to coordinate the regional development space and optimise regional industrial layout, and on the other hand, adhering to the new regional development concept, promoting urban-rural integration and promoting regional coordinated and sustainable development. Therefore, research on the regional economic differences needs to be comprehensively measured in terms of economy, society, etc., in order to grasp the situation of regional development from the overall perspective and to make regional governance scientific and effective. On the other hand, the studies of the differences of regional economic development levels facilitate the regional zoning and function positioning based on the level of regional development, so as to have a definite object in view, which is conducive to regional control.

The purpose of this study is to explore how to promote regional sustainable development from the perspective of managing regional spatial differences. The rest of this paper is structured as follows. Section 2 elaborated the ‘1+9’ spatial pattern Guangdong-Guangxi Economic Zone’s general situation. Section 3 uses Exploratory Spatial Data Analysis (ESDA) to analyse the spatial difference pattern and the spatial disharmony and imbalance of Guangdong-Guangxi Economic Region. Section 4 puts forward the countermeasures to control the spatial difference of Guangdong-Guangxi Economic Zone in order to promote regional sustainable development. Section 5 offers the conclusions.

## **2 Overview of Guangdong-Guangxi Economic Zone**

### *2.1 Proposal of Guangdong-Guangxi Economic Zone*

In the context of the new normal state, advancing regional governance with the concept of “innovation, coordination, green, openness and sharing” is an inevitable choice for modern regional development. Guangdong and Guangxi are geographically adjacent to each other, have close historical origins and similar cultures, and are communities of the Pan-Pearl River Region, so they have unique conditions for achieving interconnection. With the strengthening of regional cooperation, Guangdong and Guangxi will inevitably develop based on each other’s power. As a developed province, Guangdong must continue to expand its development space, while facing the transformation and upgrading

of traditional industries and the cultivation of emerging industries, so its interactive development with neighbouring cities is a necessity. As an underdeveloped region, Guangxi urgently needs to undertake Guangdong's industrial transfer and acquire resources such as capital, technology and human resources. Therefore, the establishment of Guangdong-Guangxi Economic Zone not only benefits the coordinated development of Guangdong and Guangxi, but also promotes the development of underdeveloped regions, which is conducive to the deepening of regional cooperation between Guangdong and Guangxi. In this context, taking 'Zhujiang-Xijiang Economic Belt' construction as an opportunity to find the starting point and common ground for the cooperation has become an urgent task. The base point for the advantage integration of Guangdong and Guangxi should be Guangdong's 'Connection with the West' and Guangxi's 'Integration to the East' strategies. The inter-provincial marginal zone of Guangdong and Guangxi with Zhaoqing and Wuzhou as the centers is the best combination point of Guangdong and Guangxi in the Xijiang Corridor. Therefore, Guangdong and Guangxi should jointly implement effective integration of resources and space based on their regional characteristics and regional advantages, so as to promote the coordinated economic development of Guangdong and Guangxi. In recent years, with the improvement of transportation infrastructure, the patency between Zhaoqing and its surrounding areas has been greatly enhanced. The supply of policies at the national and local levels is increasing, the "ASEAN Free Trade Area", the "Guangdong-Guangxi Cooperation Special Experimental Area", the "Advanced Equipment Manufacturing Industrial Belt on the West Bank of the Pearl River", the "Guangdong-Hong Kong-Macao Greater Bay Area" and other regional development strategies have been promulgated and implemented one after another, it has brought favourable policy overlapping advantages to Zhaoqing, and Zhaoqing's hub-and-gate effect has become more prominent. Zhaoqing has obvious regional advantage for its unique geographical location. It connects the east and west, and is the gateway city of the Pearl River Delta connecting the Southwest. Therefore, it is of important regional strategic significance to build a regional city system with Zhaoqing as the hub city.

## *2.2 The spatial scope of the Guangdong-Guangxi Economic Zone*

Based on the spatial distance, the study is about 300 km around the hub-type Gateway City of Zhaoqing, which connects the southwest of China with the Pearl River Delta, the formation of Guangzhou, Foshan, Zhaoqing, Qingyuan, Zhongshan, Jiangmen and Yunfu in Guangdong Province and Wuzhou, Hezhou and Yulin in Guangxi, 'Guangdong-Guangxi Economic Zone' with the spatial pattern of '1+9' with Zhaoqing as the gateway (As shown in Figure 1). The '1' refers to Zhaoqing's gateway citie and the '9' refers to nine other cities besides Zhaoqing. In 2018, the territory area of the Guangdong-Guangxi Zhuang Autonomous Region Economic Zone was 10.145 square kilometres, with a population of 49.8284 million, accounting for 32.21% of the total population of Guangdong and Guangxi provinces. The Guangdong-Guangxi Economic Zone is 70 km from Shenzhen, 40 km from Macao, 120 km from Hong Kong and 200 km from Nanning, making it one of the regions with the greatest development potential in Guangdong and Guangxi.

**Figure 1** The spatial scope of Guangdong-Guangxi Economic Zone (see online version for colours)



### 3 Research on the spatial difference of Guangdong-Guangxi Economic Zone

#### 3.1 Research methods

Exploratory Spatial Data Analysis (ESDA) studies the agglomeration condition of spatial distribution of a phenomenon or thing by describing or reproducing its spatial distribution characteristics, thereby explaining the spatial interaction mechanism between the observed (Lian et al., 2010). This study mainly applies the global spatial autocorrelation coefficient Moran’s I and the local spatial autocorrelation coefficient Local Moran’s I (Sun and Liu, 2009).

The formula for calculating the spatial autocorrelation coefficient is:

$$I = \frac{n \sum_{i=1}^n \sum_{j=1}^n W_{ij} |x_i - \bar{x}| |x_j - \bar{x}|}{\sum_{i=1}^n \sum_{j=1}^n W_{ij} \sum_{i=1}^n |x_j - \bar{x}|^2}$$

$$I_i = \frac{n(x_i - \bar{x}) \sum_j W_{ij} (x_j - \bar{x})}{\sum_i (x_i - \bar{x})^2} = Z_i \sum_j w_{ij} Z_j$$

In the formula,  $I$  is the global Moran index,  $I_i$  is the local Moran index,  $x_i$  and  $x_j$  are the per capita GDP of city  $i$  and city  $j$  respectively,  $n$  is the total number of spatial units and  $W_{ij}$  is the spatial neighbour weights. This study mainly uses the adjacency criteria to estimate the spatial weight of each city. The specific rule is: if city  $i$  and city  $j$  are adjacent,  $W_{ij}$  takes 1, otherwise takes 0.  $w_{ij}$  is the standardised form of spatial weight, and  $Z_i$  and  $Z_j$  are the standardisation of the observed value of city  $i$  and city  $j$ . It is

generally considered that the value range of autocorrelation coefficient is between  $-1$  and  $1$ .

Local Moran's  $I$  can be used to identify the agglomeration state of different spaces, thereby discovering the spatial heterogeneity of the region, and the values of  $I_i$  and  $Z_i$  become the classification criterion for the spatial characteristics of urban economic development convergence or differentiation. If  $I_i > 0$ ,  $Z_i > 0$ , city  $i$  is located in the HH quadrant of the Moran scatter plot, and the area belongs to the diffusion effect zone; if  $I_i > 0$ ,  $Z_i < 0$ , city  $i$  is in the HL quadrant of the Moran scatter plot, and the area belongs to the polar effect region; if  $I_i < 0$ ,  $Z_i > 0$ , city  $i$  is in the LH quadrant of Moran scatter plot, and the area belongs to the transition zone; if  $I_i < 0$ ,  $Z_i < 0$ , city  $i$  is in the LL quadrant of the Moran scatter plot, and the area belongs to low-speed growth zone.

### 3.2 Analysis on the difference characteristics of Guangdong-Guangxi Economic Zone

#### 3.2.1 Overall difference characteristics

Standard deviation is an important indicator reflecting the extent of the sample away from the overall average. The larger the standard deviation, the more dispersed the sample, and the larger the average difference between samples. The formula is shown as follows:

$$S = \sqrt{\sum_{i=1}^n (Y_i - \bar{Y})^2 / N} .$$

In the formula,  $N$  is the total number of study units in the study area,  $Y_i$  is the index value of the study unit  $i$ , and  $\bar{Y}$  is the average value of the index in the study area.

Using the ratio of the standard deviation to the mean, the effect of the mean can be eliminated and this ratio is called the coefficient of variation. The formula is shown as follows:

$$C_v = \frac{1}{\bar{Y}} \sqrt{\sum_{i=1}^n (Y_i - \bar{Y})^2 / N} .$$

In the formula,  $N$  is the total number of study units in the study area,  $Y_i$  is the index value of the study unit  $i$ , and  $\bar{Y}$  is the average value of the index in the study area.

From Table 1, it can be seen that between 2010 and 2017, the standard deviations between cities in the Guangdong-Guangxi Economic Zone showed an increasing trend, indicating that the average differences between cities in the Guangdong-Guangxi Economic Zone showed an enlarging trend, that is, the gap between means of the cities was widening which is caused by the imbalance of regional development caused by different regional policies and development conditions.

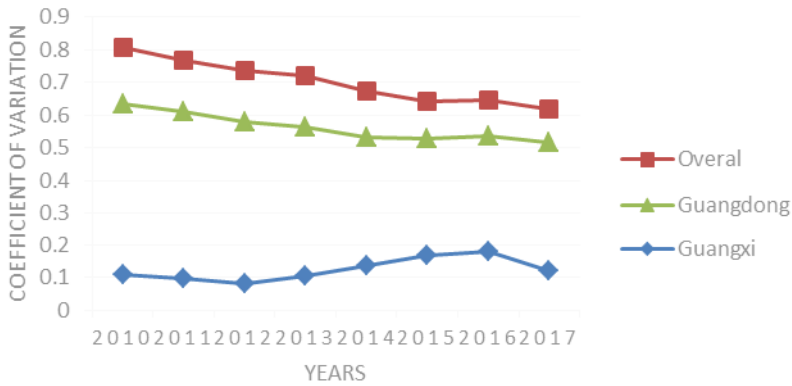
Through the coefficient of variation, it can be found that the coefficient of variation of the Guangdong-Guangxi Economic Zone during this period of time decreased first and then increased, but generally decreased, which indicated that the economic differences between cities in Guangdong-Guangxi Economic Zone generally were becoming small gradually. The reasons for this phenomenon can be explained as follows: Since China's reform and opening-up, the rapid economic development of Guangdong Province and the

relatively slow development of Guangxi have led to the greater difference in the economic development level between Guangdong and Guangxi. From 2010 to 2017, the ability of the developed regions in the Guangdong-Guangxi Zhuang Autonomous Region Economic Zone to gather the factors is getting stronger and stronger, while the ability of the less developed regions to gather the factors is relatively weaker, which forms the widening gap between cities in the Guangdong-Guangxi Economic Zone.

**Table 1** Overall differences between cities in the Guangdong-Guangxi Economic Zone

Region	Indicators	2010	2011	2012	2013	2014	2015	2016	2017
Overall	Variance	19312	21447	23474	24187	26054	28179	30509	30532
	Variation	0.808	0.767	0.738	0.721	0.672	0.643	0.647	0.608
Guangdong	Variance	19496	21629	23369	23938	25681	28367	30966	31032
	Variation	0.636	0.609	0.580	0.564	0.531	0.529	0.538	0.517
Guangxi	Variance	872	1015	960	1343	2189	3450	4078	4165
	Variation	0.107	0.098	0.080	0.104	0.134	0.166	0.179	0.118

**Figure 2** Economic differences between cities in the Guangdong-Guangxi Economic Zone (coefficient of variation) (see online version for colours)



From the perspective of provinces, the economic differences between the seven cities in Guangdong Province decreased first and then increased, which was the same as the overall trend of the Guangdong-Guangxi Economic Zone; the economic differences between the three cities in the Guangxi Autonomous Region decreased first, then increased and finally decreased again (As shown in Figure 2). This was mainly related to the level of economic development in Guangdong and Guangxi. In addition, the economic differences between the seven cities in Guangdong were larger than that in the three cities in Guangxi, which was mainly related to the number of samples in Guangdong and Guangxi. The possible reason for these phenomena is that from 2010 to 2014, Guangdong attached importance to the coordinated development of regions, and the relative gap between these cities was narrowing. However, after 2014, the development of these cities has become fragmented and the coordination of regional development is not ideal. By contrast, the regional development gap narrowed between the three cities in the Guangxi Autonomous Region from 2010 to 2012, but after 2012,

the development gap between the three cities widened. However, after 2016, Guangxi has taken corresponding measures to increase the coordinated development of these cities, and the gap in urban development has begun to narrow.

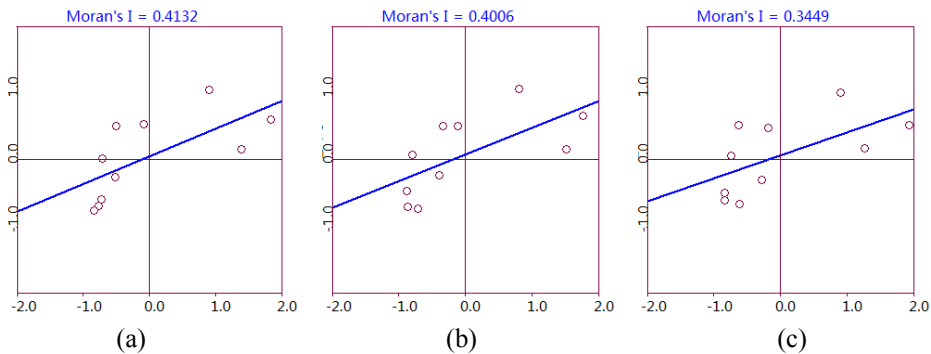
### 3.2.2 Spatial difference characteristics

According to the principle of spatial autocorrelation, OpenGeoDa software is used to calculate the global autocorrelation coefficient Global Moran's I of per capita regional GDP in the Guangdong-Guangxi Economic Zone from 2010 to 2017, and Z-value method is used to test the significance of spatial autocorrelation. The results obtained are shown in Table 2.

**Table 2** Spatial autocorrelation coefficient of per capita regional GDP in the Guangdong-Guangxi Economic Zone

Year	Moran I	E (I)	Mean	SD	Z value
2010	0.4132	-0.1111	-0.1276	0.1689	3.1042
2011	0.4080	-0.1111	-0.1497	0.1906	2.7235
2012	0.4049	-0.1111	-0.1109	0.2155	2.3944
2013	0.4006	-0.1111	-0.1026	0.2250	2.2742
2014	0.3631	-0.1111	-0.1049	0.2110	2.2474
2015	0.3510	-0.1111	-0.1111	0.2235	2.0676
2016	0.3449	-0.1111	-0.1119	0.1860	2.4516
2017	0.3357	-0.1111	-0.1016	0.1789	2.4931

**Figure 3** Moran scatter plot of per capita regional GDP in the Guangdong-Guangxi Economic Zone: (a) the year 2010; (b) the year 2013 and (c) the year 2016 (see online version for colours)



Meanwhile, based on the time characteristics of Global Moran's I, this study uses 2010, 2013, and 2016 as research sections and obtains the Moran scatter plot of per capita GDP in the Guangdong-Guangxi Economic Zone (Figure 3). The first, second, third and fourth quadrants in Figure 3 are 'high-high', 'low-high', 'low-low' and 'high-low' type. The 'high-high' type indicates that the economic development levels in the province and



its surrounding areas are relatively higher; the ‘low-high’ type indicates that the economic development level of the region itself is lower than that of surrounding areas; the ‘low-low’ type indicates that the economic development levels of the region itself and the surrounding areas are relatively lower; the ‘high-low’ type indicates that the economic development level of the region itself is higher than that of the surrounding areas. The spatial autocorrelation with positive first and third quadrants is homogeneity prominent, and the spatial autocorrelation with negative second and fourth quadrants is heterogeneity prominent.

Figure 3 shows that:

- 1 In 2010, the scatter points of per capita regional GDP scatter falling into the first quadrant and the third quadrant accounted for 30% and 40% respectively, so the cities of spatial positive correlation accounted for 70%.
- 2 In 2013 and 2016, the scatter points of per capita regional GDP falling into the first and third quadrants, and the second and fourth quarters were about the same as that in 2010, so the cities of spatial positive correlation also accounted for 70%.

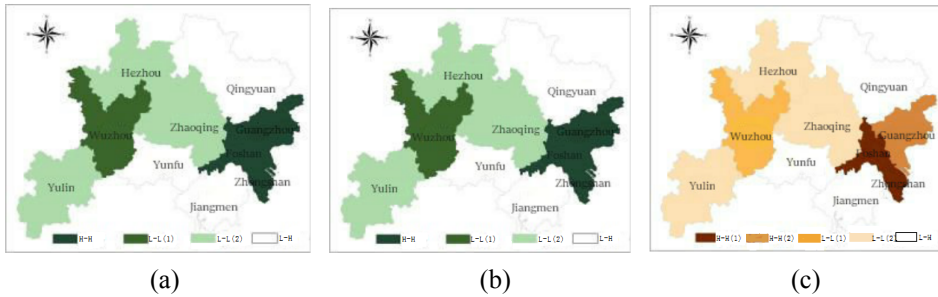
The scatter plot of per capita regional GDP in the three year shows that the economic differences between cities in the Guangdong-Guangxi Economic Zone have significant spatial correlation, and cities with similar economic development levels are spatially adjacent.

In addition, this study uses OpenGeoDa software to calculate the LISA value of per capita GDP of the Guangdong-Guangxi Economic Zone in different years. Through the Z-test ( $P < 0.05$ ), the LISA aggregation maps for 2010, 2013 and 2016 are plotted.

According to Figure 4, the cities of ‘high-high’ type were mainly Guangzhou, Foshan and Zhongshan in 2010, indicating that these regions had strong economic agglomeration and were closely related to the surrounding areas in economy; the cities of ‘low-low’ type were mainly Wuzhou, Hezhou, Yulin and Zhaoqing, and these cities were relatively underdeveloped areas in the Guangdong-Guangxi Economic Zone, with relatively less economic communication with the surrounding areas and weak economic agglomeration; the correlation in other areas was not significant, the spatial polarisation was not obvious, and they are in a low-level equilibrium state.

The LISA agglomeration diagram of the per capita GDP of the Guangdong-Guangxi Economic Zone in 2016 is the same as that in 2013. Compared with 2010 and 2013, the only change in LISA diagram of the per capita GDP of the Guangdong-Guangxi Economic Zone in 2016 is that Guangzhou no longer belongs to the ‘high-high (1)’ type (As shown in Figure 4), H-H (1) is more significant than H-H (2), and L-L (1) is more significant than L-L (2)), which may be probably due to the slowdown in the economic development of Guangzhou in recent years and its declining agglomeration (statistical data show that the growth rate of Guangzhou’s GDP in the period from 2010 to 2016 decreased from 13% to 8.2%); it may also be related to the limitation of the ESDA method (reflecting the degree of spatial concentration or dispersion of data, Guangzhou is located in the easternmost point of the Guangdong-Guangxi Economic Zone and is at the junction of Qingyuan, Zhongshan and Foshan), and the economic agglomeration of Wuzhou has increased.

**Figure 4** LISA diagram of the per capita GDP of the Guangdong-Guangxi Economic Zone: (a) the year 2010; (b) the year 2013 and (c) the year 2016 (see online version for colours)



## 4 Countermeasures and suggestions on the control of spatial differences

### 4.1 Strengthening the portal strength and effect of Zhaoqing

As a hub-type portal city connecting the Pearl River Delta to the Southwest, the development of Zhaoqing is crucial to the development of the Guangdong-Guangxi Economic Zone. Combining the situation of Zhaoqing, focusing on industrial collaboration and traffic linkage, and guiding by building an integrated transportation hub linking the Pearl River Delta with the Southwest, we should give full play to regional advantages such as location, transportation, tourism and culture, make up for the shortcomings and carry out scientific planning. On the one hand, it is necessary to expand content and upgrade quality, consolidate the strength of the city and enlarge the size of the city, in order to effectively serve as the ‘medium’ connecting the Pearl River Delta to the Southwest. On the other hand, it is necessary to optimise the quality of the city, and build an ecologically smart city through optimising and upgrading the industries. To this end, in order to strengthen the hub-type portal effect, we should focus on promoting the “five key projects”, namely, promoting infrastructure construction, and focusing on building a logistics hub; accelerating industrial transformation and upgrading, and focusing on building an industrial hub; emphasising city expansion and upgrading, and focusing on image building; promoting cultural leading projects, and focusing on building a cultural hub; implementing innovation-driven strategies and focusing on building an innovation hub.

### 4.2 Strengthening the interaction between underdeveloped regions and developed regions in the Guangdong-Guangxi Economic Zone

The overall economic development level of the Guangdong-Guangxi Economic Zone is in the unbalanced state of “high in the east and low in the west”, that is, the development level of the seven cities in Guangdong is higher than that of the three cities in Guangxi. And this unbalanced state becomes gradually serious with time, so that Guangxi should strengthen its development and provide support from the aspects of policies, resources, technology and talents. At the same time, it should intensify its cooperation with Guangdong Province and innovate the regional interactive development mode. Local governments in the region need to establish a concept of coordinated development,

strengthen their own ideas of win-win cooperation, and plan their spatial layout as a whole, to form a number of economic functional areas with reasonable layout, interactive development and distinctive features. On the one hand, as an underdeveloped region, we should strengthen cooperation with developed regions, absorb the industry transfer from developed regions, and seek the support of developed regions. On the other hand, based on regional resources and industrial characteristics, give play to their respective strengths, dislocation development. Each local government in the economic zone needs to allocate resources based on its own comparative advantages and geographical features, to avoid excessive path dependence on certain resources, and constantly adjust and optimise the industrial structure. Meanwhile, all governments should establish a sense of openness and inclusiveness, break the administrative blockade, seek common ground and breakthrough for cooperation in the differentiation, and eventually form a new governance model in which all parties collaborate and the public participate, striving to achieve a 'win-win' balance state in regional relations. It is suggested that the Guangdong-Guangxi Economic Zone establishes a joint conference system to coordinate major issues encountered in the interactive development of regional economies, to promote the common development of all cities.

#### *4.3 Defining and relocating the function of each region*

The Guangdong-Guangxi Economic Zone should issue a catalogue of industrial development guidance and clarify the direction of industrial development based on national industrial development policies and regional realities. All cities should be encouraged to exert their regional comparative advantages, close upstream and downstream links of industries and jointly build a cross-regional industrial cluster with strong competitiveness. Guangzhou should actively promote the urban integration of Guangzhou and Foshan and the integration of Guangzhou, Foshan and Zhaoqing, speed up the pace of structural adjustment, transformation and upgrading, innovate the institutional mechanism of opening up, increase their own economic strength and radiation driving capability, and play its leading role. Foshan can rely on the advantages of manufacturing industries to develop fields such as machinery and equipment, electronic information, automobile manufacturing and financial back-office services, and strive to build an international industrial manufacturing center and Guangdong's industrial service demonstration zone. Zhaoqing should give play to its geographical advantage of linking the eastern and western regions, promote various transportation methods such as roads, railways and shipping to maximise their advantages, play the role of a demonstration platform of the Guangdong-Guangxi Special Cooperation Experimental Zone, and enhance the construction of the co-construction district. Based on this, Zhaoqing would become an important logistics base and industrial transfer and undertaking base of the whole Pearl River Delta region as well as the southwestern region, an important transportation hub connecting the Pearl River Delta to the southwest, and a 'medium' of regional alliance. Other cities such as Jiangmen, Zhongshan, Qingyuan, Yunfu, Wuzhou, Yulin and Hezhou should strengthen the functions of factor gathering, production and service, strengthen their economic ties with Guangzhou, Foshan and Zhaoqing, enhance their competitiveness and play a good role in the rapid development of the Guangdong-Guangxi Economic Zone.

#### *4.4 Innovation is the key to promoting regional synergy and innovation and accelerating regional green transformation and upgrading economic development*

Regional Synergy innovation breaks through the traditional regional development model, promotes regional competitiveness and achieves multi-win through the synergy effect among regions. Under the background of the new normal economy, we should take the new development idea as the guidance and promote the regional transformation and upgrading. Through the realisation of regional green development, regional development differences can be reduced. The sustainable development of regional space objectively requires the transformation of regional green development and the promotion of regional high-quality development through regional collaborative innovation. The linkage development of Guangdong-Guangxi Economic Zone must be supported by scientific and technological innovation, Management Innovation and system innovation. We will give full play to the role of regional high-tech development zones, science park, research institutes and other carriers so as to create a favourable atmosphere and environment for positive interaction and coordinated development of regional innovation. Guangzhou, Foshan, Zhaoqing, Zhongshan and other Pearl River Delta cities are members of the Guangdong-Hong Kong-Macao Greater Bay area and important cities in the Guangdong-Guangxi Economic Zone. The cities of Wuzhou, Hezhou and Yulin, which are located in the inland and offshore areas, are mainly resource-based in terms of industry, backward in infrastructure, relatively less open to the outside world and underdeveloped in terms of economic development, at the same time, we should strengthen the collaborative innovation with developed cities.

## **5 Conclusion**

Space Difference of control is an effective way to promote sustainable development. Through the exploratory analysis of spatial data, it is found that the Guangdong-Guangxi Economic Zone is uncoordinated in space. From 2010 to 2016, the agglomeration of developed and less-developed regions has increased, which leads to the enlargement of the overall spatial diversity of Guangdong-Guangxi Economic Zone. From the time cross-section, the 'high-high' type of cities are mainly Guangzhou, Foshan and Zhongshan, which shows that these regions have a strong economic agglomeration and are closely connected with the surrounding areas, while the 'low-low' type of cities are mainly Wuzhou, Hezhou, Yulin and Zhaoqing, these cities are relatively undeveloped areas in the Guangdong-Guangxi Economic Zone. They have little economic connection with the surrounding areas. The correlation between these cities and other areas is not significant, and the spatial polarisation of most cities is not obvious. Therefore, the study argues that, to consolidate the strength of Zhaoqing City, strengthen its hub-and-gate effect; to increase the linkage between the underdeveloped regions and the developed regions in the Guangdong-Guangxi Economic Zone; to clarify and reposition the functions of each region, etc., it becomes the key to promote the coordinated development of Guangdong-Guangxi Economic Zone in space, and is also an important path to achieve sustainable development.

## Acknowledgements

The author would like to thank the financial support provided by the Guangdong Province Science and Technology Innovation Strategy Special Fund (Soft Science) under Grant No. 2020A1010020057.

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