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Research on the determination, dynamic evolution and spatial autocorrelation of the green development level in Hefei metropolitan area

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Abstract: *The global Moran index was used to further study the spatial evolution characteristics of each city in the Hefei metropolitan area. The green development level of Hefei metropolitan area is gradually improving over time, but the unbalanced development within the metropolitan area is significant. The green development level of central cities such as Hefei and Wuhu is higher than that of the edge cities of the metropolitan area. The green development level of the Hefei metropolitan area shows an obvious and overall positive spatial correlation, and the green development level of each city is significantly influenced by several other cities in the Hefei metropolitan area. With the aggravation of the contradiction between economic development and resources and environment, "green development" is no longer just a problem in the economic field or natural environment, but an all-round link problem of "economy-environment-society", and it is the direction that must focus on development under the new development pattern.*

Keywords: *Hefei metropolitan area; green development level; horizontal method; dynamic evolution; space autocorrelation*

1. Foreword

In recent years, as global warming and the intensification of regional environmental pollution have become one of the great challenges facing the development of human society, "green development" has become a global response consensus, and countries have formulated green development strategies. From abroad, the United States invests in clean energy to stimulate the research and development of new alternative energy; South Korea launched a green energy strategy to build a "low carbon green growth" energy independent country. Domestically, the Fifth Plenary Session of the 18th CPC Central Committee elevated the concept of green development to the national decision; the 13th Five-Year Plan clearly puts green development in a prominent position, continuously improve the ecological environment and enhance the ecological governance capacity; The 14th Five-Year Plan also explains green development. It can be seen that the concept of "green development" is expounded in both the 13th Five-Year Plan and the 14th Five-Year Plan, highlighting its importance.

In 2021, China actively promote the construction of ecological civilization, under the new development pattern, the party central committee with comrade xi as the core adhere to the new concept of development, promote green transformation in economic development, achieve greater development in the green transformation, and city circle is the core content of the new urbanization construction, is crucial to promote regional economic development with high quality. At the beginning of this century, in order to focus on the development of provincial capital city, Anhui province began to build in Hefei as the main body of the economic model, 2009 "Hefei economic circle" formally proposed, and in the original more joined the surrounding cities, in May 2016 Hefei economic circle was included in the Yangtze river delta urban agglomeration, and rising from urban construction strategy for the national development strategy. Hefei urban enclosure is located in the central region of Anhui Province, and has unique development prospects with the advantages of "Belt and Road" and the important hub city cluster of the Yangtze River Economic Belt. As the central city of Hefei metropolitan area, Hefei has unique development advantages and huge development potential. Since its establishment, with Hefei as the leading city and targeting "big city", it has achieved remarkable results and gradually become a representative of the metropolitan area with great influence. How to make scientific evaluation of Hefei metropolitan area under the background of the new era, make better use of its own advantages, and

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explore the influencing factors to promote the high-quality development of regional economy is the key problem to be solved urgently to enhance the energy level of Hefei capital city and accelerate the green development of Hefei metropolitan area.

At present, there is no clear conclusion on the definition and connotation of "green development" in the academic circles. In the middle of the last century, an American scholar vividly introduced the concept of "green development" with the economic theory of space spacecraft, which opened the prelude to the exploration of green development [1]. Since then, many scholars have enriched the concept of "green development" of the company. During this period, the exploration of green development was mainly focused on protecting the environment. With the continuous development of economy and society, the academic interpretation of the concept of green development has been updated, and its research focus has gradually shifted to the coordinated and sustainable development mode of maintaining economic growth in protecting the environment. Until 2010, the United Nations development program formally put forward the connotation of the green economy, it points out that "green economy can bring human happiness and social fairness" [2], in 2012, the United Nations conference on sustainable development of the connotation to improve and complement, constructive put forward the green development not only bring convenience to human life, more can avoid more environment to economic life, to attract more people give attention to good environment.[3] At present, most foreign scholars' research on green development mainly focuses on green industry, green energy, green economy and other aspects.

Li Lin by building a comprehensive evaluation system of Chinese urban agglomeration green development of time and space characteristics and heterogeneity in recent years, with the continuous development of economy, more and more economic development burden of the impact on the environment, so pay more attention to the popularity of green development concept and build a new development pattern, academic research on related issues has become a hot spot, the increasingly rich results. In general, the existing research mainly focuses on two aspects: (1) basic concepts and theories.

Some scholars believe that green development is to pay attention to environmental protection and resource conservation, and promote the harmonious coexistence between man and nature.[4] Some scholars believe that green development is to discover new alternative energy sources through scientific and technological innovation, reduce the consumption of natural resources, and make economic development on the road of green development.[5] (2) As a new concept in the research field, the green development level has attracted many scholars to conduct in-depth analysis and measurement evaluation. The impact of green development on urban economic development is clearly put forward.[6] Xu Ye and Ouyang Wanhua dynamically measured the green development level of cities in Jiangxi Province by constructing the measurement system of urban green development level and analyzed its influence mechanism.

Compared with the existing research, this paper has the following possible innovation: ① research perspective, this paper selected two sections and panel data, from the two dimensions of time and space of Hefei city circle green development level of comprehensive measurement, fully considering the time factors and geographical location on the influence of urban green development.② In terms of empirical strategies, the previous multi-index measurement system of green development refers to reflecting the progress of green development from various perspectives through a series of core indicators, without the need for index weighting. In this paper, the "vertical and horizontal direction" is applied to open the grade method to measure the weight of all levels of indicators, thus obtaining the promotion degree of different types of indicators to the level of green development.

2. Study methods and data sources

2.1 Data source

The data of this paper are from 2005-2019 Anhui Provincial Statistical Yearbook, Hefei Statistical Yearbook, Wuhu Statistical Yearbook, Bengbu Statistical Yearbook, Huainan Statistical Yearbook, Chuzhou Statistical Yearbook, Maanshan Statistical Yearbook and Lu'an Statistical Yearbook. Due to the lack of content in some early urban statistical yearbooks, some indicators were replaced according to the "Calculation of Green Development Level" issued by the National Development and Reform Commission, while for the missing data, the "epitaxial method" or "mean method" was adopted. Twenty indicators were finalized based on the availability of the data.

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2.2 Construction of the index system

Drawing on existing studies at home and abroad, we can summarize the connotation of green development from the following two aspects: First, pay attention to protecting the ecological environment, on the one hand, pay attention to saving natural resources and maintaining ecological balance, on the other hand, pay attention to reducing pollution to achieve the two-carbon goal. The second is to support the development of new energy enterprises, on the one hand, emphasize the importance of developing new energy enterprises, discover new alternative resources through high technology; on the other hand, focus on the "greening" in the process of economic activities, while improving the level of economic development while paying attention to green environmental protection to reduce the negative impact of economic development on the environment. "Green development index" is an important reference to evaluate the local green development level. At present, the indicators in China mainly start with "pollution prevention and control," green life "and" green economy ". Due to our early rush to economic development, to forget the environmental protection, most of the factory pollutant emissions is very large, and in recent years, especially after chairman xi proposed concept, local governments realized the importance of protecting the environment, a large number of polluting enterprises transformation or closed, and there will be a big fluctuation in pollutant emissions, which can use these as indicators. In terms of "green life", people often have the difference between clothing, food, housing, transportation and non-green. When they deeply understand President 's speech, more and more people understand the meaning of "green life", such as choosing buses and new energy vehicles. The choice of people and the masses also makes "green life" an important representative of the index system. The same is true of "green economy". In recent years, there are many emerging "green enterprises". These enterprises do not abandon their own economic interests, but achieve a win-win situation in development, but can get more benefits. The state is also strongly supporting these enterprises, providing a lot of convenience for new energy enterprises.

Based on this, this paper fully discusses the index selection methods of excellent scholars, finds the most suitable and most scientific indicators, and at the same time, starting from the connotation of the green development level of Hefei metropolitan area, constructs the comprehensive evaluation index system of the green development level of Hefei metropolitan area (see Table 1). In this paper, the hierarchical analysis method (AHP) is applied to take the green development level as the target layer, and construct three criterion layers, which, transformation support, transformation output and transformation performance. Under the criterion layer, there are 11 first-level indicators and 20 second-level indicators respectively.

Table 1: Comprehensive evaluation index system of green development level in Hefei metropolitan area

TARGET LAYER	THE STANDARD LAYER	LEVEL 1 INDICATORS	SECONDARY INDICATORS
GREEN DEVELOPMENT	Transformation support	prevention and control of pollution	Industrial sulfur dioxide emissions reduction (ton)
			Reduction of industrial nitrogen oxide emissions (ton)
		comprehensive ecological improvement	The harmless treatment rate of household garbage is (%)
			The centralized treatment rate of the sewage treatment plant in the whole city is (%)
			The comprehensive utilization rate of general industrial solid waste is (%)
	Conversion of output	Growth subject	Regional GDP per capita (yuan / per person)
			Regional GDP (RMB ten thousand yuan)
		The proportion of growth	The tertiary industry accounts for (%) in GDP
			Employment rate in the tertiary industry is (%)
		Growth input	Electricity
			Local general public budget expenditure _ municipal district _ ten thousand yuan
			Science and technology expenditure _ municipal district (ten thousand yuan)
		Green growth	Regional GDP growth rate _ the whole city (%)
			Transaction of land construction land area (square meters)
	Transformation performance	Green cover	Green coverage rate of built-up area _ (%)
			Green coverage area of the built-up area _ municipal district (ha)
		trip mode	Every 10,000 people _ the city (car)
		health care	Number of beds in hospitals and health hospitals _ whole city (Zhang)
		Green space sharing	Park green space area _ municipal district (ha)
		green living	Total volume of public transport (ten thousand person-times)

The transformation support includes measures taken by cities in the Hefei metropolitan area in order to improve the environment, reorganizing or suspending enterprises with high emissions of pollutants, and investing heavily in pollution prevention and control. In this way, it can not only promote the improvement of green development level, but also build a good environment suitable for high-tech

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industries and new energy enterprises in Hefei metropolitan area, so as to attract more domestic and foreign enterprises to settle in, and truly realize the new development pattern. As far as Hefei is concerned, in recent years, many top 500 enterprises have settled in Hefei, which not only drives Hefei's economy, but also brings benefits to other cities in the Hefei metropolitan area.

In the transformation output, we can see from the panel data that green development does not develop the economy, but does not cause economic regression, but can provide more jobs for the people. With the entry of enterprises, it is inevitable to provide a large number of high-quality positions, which can also attract more talents to nurture the urban construction.

In terms of transformation performance, to judge the level of green development of a city, we must pay attention to grass-roots construction and build more facilities that are also beneficial to the people, so that the people can really feel that their living standards have been improved.

2.3 "Vertical and horizontal direction" to open the grade method

There are many ways to measure the level of green development, often depending on the choice of indicators. In the process of index selection, if the relationship between the indicators is not very close, the weight ratio of each index is determined according to the previous research results. When the selected index has a certain connection, the entropy method and other methods are used to determine the index weight. For the first type of subjective methods, there is insufficient shortage of reference due to the lack of research in this area. However, due to the large time span of the index selected in this paper, the entropy method and other methods cannot solve the effects of different times. Therefore, this paper adopts the "horizontal and horizontal" open-grade opening method [7] proposed by Guo Yajun. The "vertical and horizontal" method can help determine the difference brought by the event, and can also consider the time weight, so that the index with a large time span can also determine the weight of the analysis. The steps of the "vertical and horizontal direction" drawing method are as follows:

$$y_i(t_k)=\sum_{j=1}^{m}\omega_j x_{ij}(t_k),(i=1,2,...,n;\ j=1,2,...,m;k=1,2,...,T) \tag{1}$$

In time, $x_{ij}(t_k)$ the first index value of the first evaluation object represents the weight of the first index, and $y_i(t_k)$ represents the comprehensive score value of the first evaluation object in time.

First, the index data is standardized and mainly adopts the extreme method. For positive indicators (expect a larger value is better, such as regional GDP per capita). Its standardized processing formula is as $x'_{ij}(t_k)=\dfrac{x_{ij}(t_k)-m_j}{M_j-m_j}$. For the reverse index (the smaller the value is expected, the better, such as sulfur dioxide emissions), the standardized treatment formula is: $x'_{ij}(t_k)=\dfrac{M_j-x_{ij}(t_k)}{M_j-m_j}$,In the formula, $m_j=\min\{x_{ij}(t_k)\}, M_j=\max\{x_{ij}(t_k)\}$,Standardized for the processed data $x'_{ij}(t_k)\in[0,1]$.

Secondly, determine the weight of the evaluation index $\omega_j\ (j=1,2,\cdots,m)$.The principle is to reflect to the greatest possible extent the differences between the evaluated objects, namely the order $y_i(t_k)$ the total deviation of $e^2=\sum_{k=1}^{T}\sum_{i=1}^{n}(y_i(t_k)-\bar{y})^2$ take the maximum value,Due to the standardized processing of the raw data, $\bar{y}=\dfrac{1}{T}\sum_{k=1}^{T}\left(\dfrac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{m}\omega_j x_{ij}(t_k)\right)=0$,therefore,

$$e^2=\sum_{k=1}^{T}\sum_{i=1}^{n}\left(y_i(t_k)\right)^2=\sum_{k=1}^{T}\left[W^T H_k W\right]=W^T\sum_{k=1}^{T}H_k W=W^T HW \tag{2}$$

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Among, $W=(\omega_1,\omega_2,\cdots,\omega_m)^T, H=\sum_{k=1}^{T}H_k$ is a $m\times m$ of the symmetry matrix,but $H_k=X_k^TX_k(k=1,2,\cdots,T)$, $X_k=\begin{bmatrix} x_{11}(t_k) & \cdots & x_{1m}(t_k) \\ \square & \cdots & \square \\ x_{n1}(t_k) & \cdots & x_{nm}(t_k) \end{bmatrix}$.Thus, it can be proved that: if limited $WW^T=1$,The matrix H of the maximum eigenvalue corresponding to the eigenvector W is the weight coefficient, this moment, e^2 is Take the maximum value.

Finally, the comprehensive score value of the evaluation object is calculated $y_i(t_k)$.

2.4 Global spatial autocorrelation method

The global Moran index (Global Moran's I) reflects the dispersion effect [8-15] of the regional cells through the approximation of the spatial neighborhood cell properties. Spatial autocorrelation was first used to observe the correlation between geographical location and index data, and when applied to the intercorrelation between cities, the communication and influence mechanism between a central city and a surrounding city can be more intuitively observed. Therefore, this paper uses the spatial distribution degree of the green development level in Hefei metropolitan area within the time limit of the global spatial autocorrelation exploration, and then reveals the spatial differentiation state and evolution trend of the green development level.

$$I=\frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}\omega_{ij}(x_i-\bar{x})(x_j-\bar{x})}{(\sum_{i=1}^{n}\sum_{j=1}^{nn}\omega_{ij})\sum_{i=1}^{n}(x_i-\bar{x})^2} \tag{3}$$

Moran's I index results between-1 and 1, I> 0 indicates the positive correlation, indicating that the larger the value clusters together, the more obvious the similar attribute clustering distribution in space; when I tends to 0, the representative attribute is randomly distributed, or there is no spatial autocorrelation. The above analysis needs to meet the statistical significance of the p-value.

3. Measurement results of the green development level in Hefei metropolitan area

In this paper, Python3.10 software is used to process the three-dimensional temporal stereoscopic data, and finally get the 3 criterion layer weights, 11 first-level index weights and 20 second-level index weights, and accordingly calculate the final measurement value of the green development level of 7 cities in Hefei metropolitan area.

Table 2: Index weight of all levels of green development level in Hefei metropolitan area

TARGET LAYER	THE STANDARD LAYER	CRITERION LAYER WEIGHT	LEVEL 1 INDICATORS	LEVEL 1 INDEX WEIGHT	SECONDARY INDICATORS	SECONDARY INDEX WEIGHT
THE ABILITY TO TRANSFORM SCIENTIFIC AND TECHNOLOGICAL ACHIEVEMENTS	Transformation support	0.3951	prevention and control of pollution	0.3075	Industrial sulfur dioxide emissions reduction (ton)	0.4827
					Reduction of industrial nitrogen oxide emissions (ton)	0.5173
			comprehensive ecological improvement	0.6925	The harmless treatment rate of household garbage is (%)	0.3223
					The centralized treatment rate of the sewage treatment plant in the whole city is (%)	0.3347
					The comprehensive utilization rate of general industrial solid waste is (%)	0.3430
	Conversion of output	0.3074	Growth subject	0.2164	Regional GDP per capita (yuan / per person)	0.5425
					Regional GDP (RMB ten thousand yuan)	0.4575
			The proportion of growth	0.2759	The tertiary industry accounts for (%) in GDP	0.3353

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					Employment rate in the tertiary industry is (%)	0.6647
			Growth input	0.2168	Electricity	0.3337
					Local general public budget expenditure _ municipal district _ ten thousand yuan	0.3249
					Science and technology expenditure _ municipal district (ten thousand yuan)	0.3413
			Green growth	0.2909	Regional GDP growth rate _ the whole city (%)	0.5901
					Transaction of land construction land area (square meters)	0.4098
	Transformation performance	0.2975	Green cover	0.2897	Green coverage rate of built-up area _ (%)	0.6318
					Green coverage area of the built-up area _ municipal district (ha)	0.3682
			trip mode	0.1544	Every 10,000 people _ the city (car)	1.0000
			health care	0.1934	Number of beds in hospitals and health hospitals _ whole city (Zhang)	1.0000
			Green space sharing	0.1548	Park green space area _ municipal district (ha)	1.0000
			green living	0.2076	Total volume of public transport (ten thousand person-times)	1.0000

From the index weight analysis (table 2), for Hefei city circle green development level is the biggest environmental governance (0.2308), pollution prevention (0.1025) and green growth (0.0970), and travel mode (0.0515), green sharing (0.0516), health (0.0645) effect is not obvious, on the one hand, Hefei city circle in the process of promoting green development still depends on the macro environmental governance, endogenous driving effect is insufficient. On the other hand, it also reflects that the regional green development mode in the emergence stage is still linear and extensive development, which has not yet played the horizontal transfer feedback role and cluster effect of the economic elements of the tertiary industry, and relatively ignores the optimization and upgrading process of the industrial structure, which will inevitably lead to the phenomenon of inefficient resource allocation in the regional development.

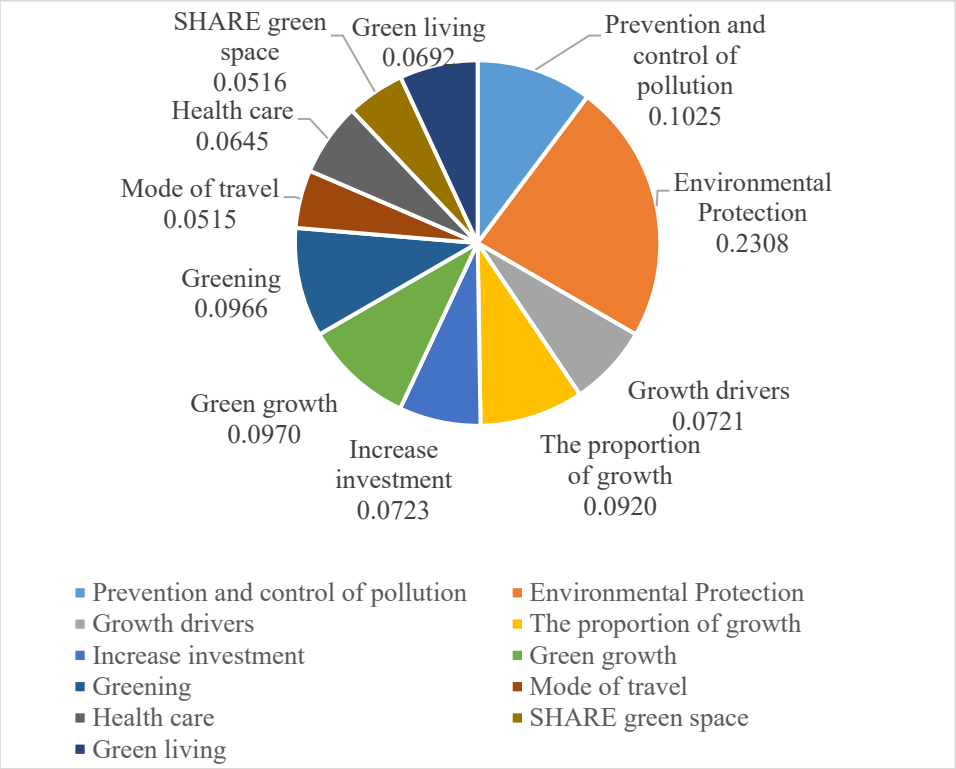

Figure 1: Proportion of the first-level index

Combined with Figure 1, we can intuitively see the weights of different indicators. At present, due to the geographical limitation of the geographical location, Hefei metropolitan area cannot attract too many enterprises to come to enter like Shanghai metropolitan area and Nanjing metropolitan area, so it has missed many opportunities in history and its development is relatively slow. In recent years, Hefei metropolitan area has actively invited many emerging enterprises to enter, especially new energy enterprises. In the process of economic development to green economy, how to implement green

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development to the end and how to let the people truly feel the advantages of green development to support green development has become a difficult problem facing policy makers. From the perspective of index weight, there is still less welfare for the common people. I hope that in the future, the cities in the metropolitan area can pay more attention to the needs of the people at the bottom and build more livelihood projects[16-20].

Combined with Figure 2, 20 secondary indicators are selected to measure the green development level of Hefei metropolitan area from multiple dimensions such as environmental governance, green investment, social life and people's livelihood.

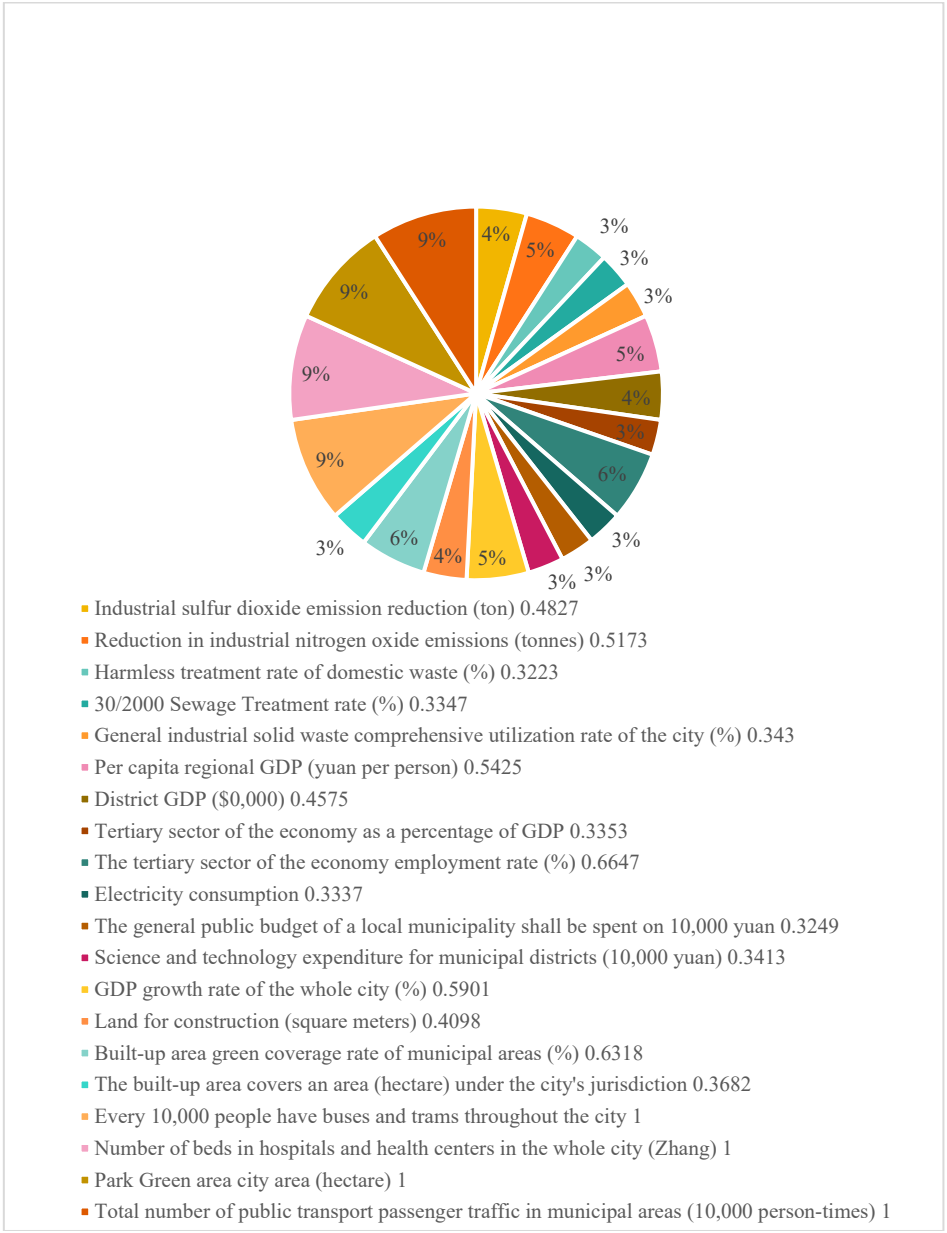

Figure 2: Proportion of secondary indicators

To sum up, the investment in environmental governance in Hefei metropolitan area has been greatly improved compared with the previous one. Environmental governance accounts for a large proportion in the whole green development index system, but the gap between different indicators is also obvious, which is of great help to the authenticity of the conclusion. Hefei metropolitan circle city from the initial rapid development of economy to the green development in recent years has made great progress, but also due to the development of Hefei metropolitan circle is unbalanced, the city attention to people grassroots life has yet to catch up with the speed of economic development, which also led to the secondary indicators of the people's livelihood weight is small. In the process of greening coverage, especially in the land construction in the built-up areas, the greening coverage rate in many places is not

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too much, but it is also rising steadily, which also shows that people prefer the community with good environment, and can drive the surrounding economic development after migration, thus forming a virtuous circle. In general, the urban population in Hefei metropolitan area is still dominated by rural residents, so more welfare policies should be incorporated to rural areas, and convenient livelihood projects should be built in more villages.

4. The dynamic evolution of the green development level in the Hefei metropolitan area

Table 3: Time weight of green development indicators in Hefei metropolitan area from 2005 to 2019

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Time weight(%)	4.49	4.72	4.98	5.25	5.54	5.84	6.16	6.49	6.85	7.22	7.61	8.02	8.47	8.93	9.43

Note: All the obtained data (%) retain 2 decimal places

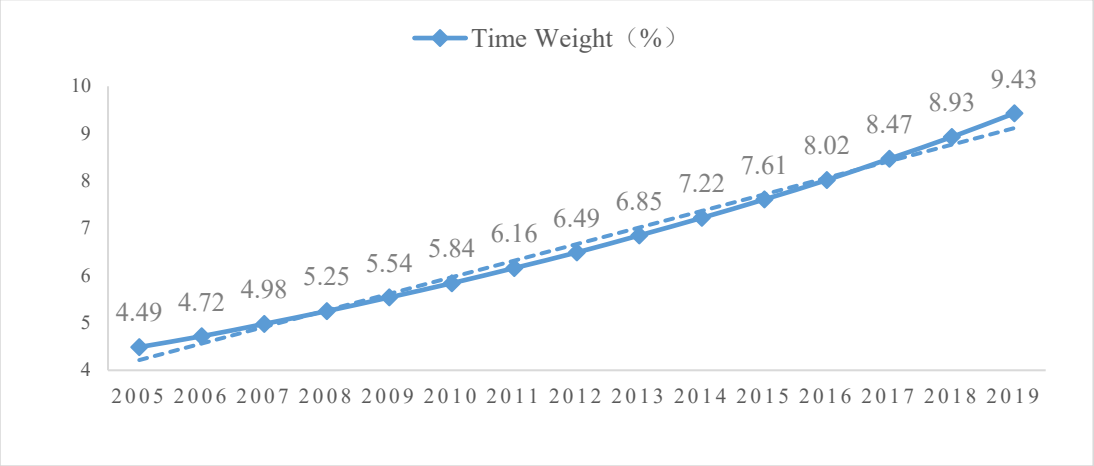

Figure 3: Time weight trend diagram in 2005-2019

Table 4: Final measurement value of the green development level in Hefei metropolitan area

	Bengbu	Hefei	Huainan	Wuhu	Chuzhou	Ma'an Mountain	Lu'an
2005	1.5920	1.8555	1.5727	1.7271	1.7022	1.7148	1.4138
2006	1.6054	1.9338	1.6864	1.7467	1.7642	1.6991	1.5710
2007	1.6203	1.8705	1.6852	1.6820	1.7822	1.7327	1.7185
2008	1.6782	1.9121	1.6688	1.9137	1.6034	1.7199	1.6938
2009	1.7307	2.0758	1.6201	1.9430	1.6236	1.6820	1.7055
2010	1.8239	2.1105	1.6696	1.9647	1.7049	1.7184	1.7766
2011	1.8477	2.1538	1.7943	1.9265	1.8526	1.7763	1.6919
2012	1.8614	2.2614	1.9249	2.1064	1.8906	1.9327	1.7831
2013	1.8816	2.2781	1.7805	2.0489	1.9508	1.7939	1.8011
2014	1.8335	2.2378	1.7923	1.9868	1.8816	1.7897	1.7732
2015	1.9170	2.2884	1.7836	1.9816	1.9107	1.8842	1.8233
2016	1.9287	2.3088	1.8378	1.9794	1.8587	1.8987	1.7403
2017	1.9431	2.3195	1.8824	1.9804	1.9495	1.9729	1.9132
2018	1.9309	2.2075	1.8564	1.9367	1.9393	1.8817	1.8658
2019	1.9263	2.2931	1.8828	1.9819	1.9649	1.9117	1.8920
Final measure value	1.8328	2.1714	1.7811	1.9423	1.8457	1.8249	1.7662
ranking	4	1	6	2	3	5	7

Note: All the obtained data are retained in 4 decimal places

Table 3 and Figure 3 shows the trend chart of the evaluation index of Hefei metropolitan area from 2005 to 2019. According to the analysis in Table 4 and Figure 4, on the whole, the green development level of Hefei metropolitan area has increased in the past 14 years, and the comprehensive scores of Hefei and Wuhu are generally higher than that of several other cities. Taking Wuhu as an example, it can be seen that the green development level of Wuhu is rising steadily in recent years. In the first few years, we have realized the importance of protecting the environment, and set off a nationwide trend of energy conservation and emission reduction , as shown in Table 3. In the Olympic cycle, due to the "financial crisis", local governments must adhere to production, and economic development is more inclined to basic industries that are not environmentally friendly. In the following years, the economic growth rate gradually stabilized, which led to the same stabilization of the green development level index, although it declined, but the overall comprehensive score was high. As the capital city of Anhui Province, Hefei is also outstanding in the level of green development. While its economy is steadily improving, Hefei

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has not given up the pursuit of green development, and is also outstanding in the construction of basic livelihood facilities. For other cities in the Hefei metropolitan area, the amount of GDP is not completely related to the level of green development, which can be seen that the investment of different cities in green development is different. For cities with less GDP, increased investment in environmental governance and environmental protection facilities will also have a higher level of green development[21-22].

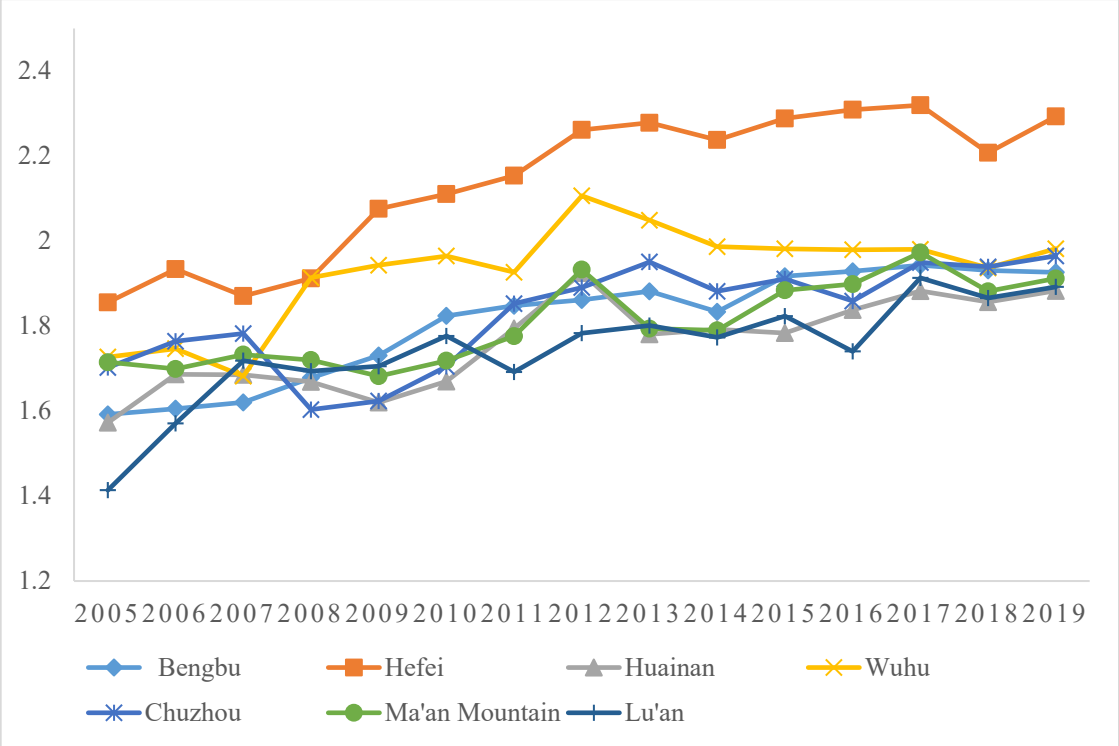

Figure 4: Dynamic evolution trend diagram of the green development level in Hefei metropolitan area

Figure 5 comprehensive evaluation of Hefei metropolitan area. We can intuitively see seven cities of green development level of comprehensive evaluation score ranking, in order, Hefei, Wuhu, Chuzhou, Bengbu, ma on shan, Huainan, Lu 'an, overall, the seven cities of green development level comprehensive evaluation index is not big, the Hefei green development level of comprehensive evaluation index of 2.1714, Lu' an green development level of comprehensive evaluation index of 1.7662.

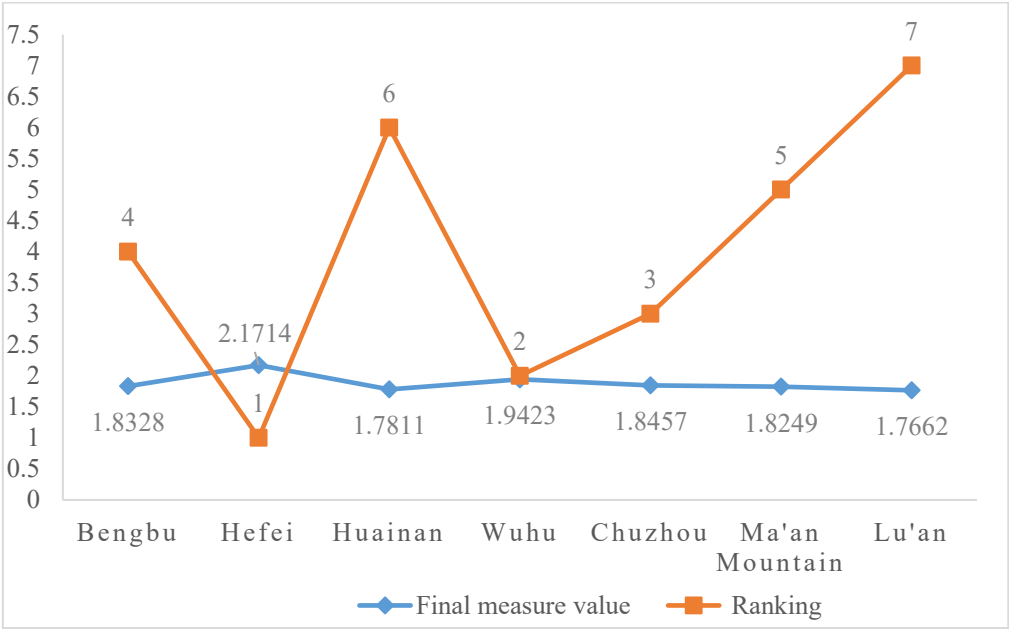

Figure 5: Trend chart of the comprehensive evaluation of the cities in the Hefei metropolitan area

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5. Spatial difference and source analysis of green development level in Hefei metropolitan area

The Moran's I index of the global spatial autocorrelation was calculated by using ArcGIS software to analyze the spatial correlation of the green development level of each city in the Hefei metropolitan area. Here, the four sections of 2005, 2010, 2015 and 2019 are selected to calculate the Moran index of these four span years, so as to see the time trend of urban development.

As can be seen from Table 5, Moran's I index is positive, and the Z value is basically greater than the critical value of 0.05 confidence level of 1.96, indicating that the green development level measure of Hefei metropolitan area shows a positive spatial correlation in all years, and the green development level of each city is significantly affected by several other cities in the Hefei metropolitan area. With the passage of time, the positive relationship between cities in Hefei is gradually rising, which also corresponds to the government's policies. With the economic growth of Hefei, the policies have increased its economic exchanges and environmental protection exchanges with other cities. In the foreseeable future, Hefei metropolitan area will certainly be closely united together and integrate talent resources with each other.

Table 5: Overall autocorrelation test results of the green development level of Hefei metropolitan area in 2005- 2019

	THE MORAN'S I INDEX	P VALUE	Z SCORE
2005	0.282	0.241	1.73
2010	0.302	0.040	2.12
2015	0.390	0.033	2.53
2019	0.445	0.019	2.45

6. Conclusions

6.1 Main conclusions

In this paper through the development committee released in 2016, the green development system and 2005-2019 city data constructed the Hefei city circle green development level measurement index, through the "vertical and horizontal to pull class method", calculate the weight of primary and secondary index, and calculate the time weight of 2005-2019,70 dynamic cities to Hefei city circle, then this paper adopts the global space correlation analysis method to further study the cities in Anhui province spatial evolution characteristics. The following conclusions are mainly obtained:

First, the comprehensive analysis of the connotation of 20 indicators, combined with the calculation of weight, in environmental governance, green investment, social life, the well-being of the people's livelihood, and other multiple dimensions, we can get environmental governance indicators in the proportion of the green development level, about 23% of the green development level, and travel, the proportion of green sharing index is relatively small, accounts for only about 5%. Therefore, the future development focus of Hefei metropolitan area should start from the connotation of green development level, put environmental factors in a crucial position, give full consideration to the influence of various indicators, rationally allocate resources, and ensure the steady progress of green development.

Second, the green development level of several cities in the Hefei metropolitan area has shown an increasing trend over time, from 4.49% in 2005 to 9.43% in 2019, but there is an obvious gap in the green development speed of each city.

6.2 Main suggestions

First, give full play to the role of Hefei as a central city and gradually form the integration of metropolitan areas. As the central city of Hefei metropolitan area, Hefei has unique development advantages and huge development potential. Since its establishment, Hefei metropolitan area has taken Hefei as the leading city and "big city" as the goal, achieved remarkable results and gradually become a representative of the metropolitan area with great influence. According to the latest statement of the Provincial Development and Reform Commission, the next work of Hefei metropolitan area will focus on the existing development, constantly improve the quality of development, accelerate the pace of urbanization, constantly deepen the coordination and linkage with the Yangtze River Delta metropolitan area, and commit to building an influential international metropolitan area.

Second, Hefei metropolitan area should focus on building a green industrial chain, so that economic

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development and green development can be out simultaneously. In the next few years, Hefei metropolitan area should focus on the integrated development of green industries, strengthen the coordination, dislocation development and functional complementarity of regional advantageous industries, realize the strong chain reinforcement and chain extension of industries within the metropolitan circle, and use "spillover benefits" to drive the high-quality dislocation development of cities within the circle, and form cluster advantages. Keep pace with the implementation of the new development concept, the innovation, green, sharing into the emerging industries, with green environmental protection, to develop the green economy, form resource sharing between cities, combining, with strong with weak, a clear division of labor cooperation projects, make city circle center, city circle, city circle peripheral three lines of productivity get qualitative leap. At the same time, efforts to improve the service function of Hefei city circle, improve the transportation industry, dedicated to Hefei city circle stability to the good green new development, the industry upgrading of the Yangtze river delta region and overall strength also plays an important role, also to a certain extent, promote the development of the central and western regions in China.

Third, optimize the industrial structure of the Hefei metropolitan area and pay attention to the development of new industries. While building a new development pattern, we should also focus on the layout of green development. Cities with better economic development should pay more attention to green development and realize the linkage between economic development and green development. Metropolitan areas coordinate with each other to form an ecological industrial chain with internal and external linkage. At the same time, the development of tourism will also drive the local economic development to a certain extent, by giving full play to the advantages of green resources and gradually forming a green metropolitan circle.

We will establish and improve the incentive mechanism to attract the inflow of high-quality and high-capable talents, vigorously develop higher quality-oriented education and professional vocational and technical training, focus on improving the quality of education at all levels, and optimize the structure of the tertiary industry such as the education industry.

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