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Evolution Study on Green Urbanization Spatial Pattern of Poyang Lake Eco-economic Zone Based on Spatial Autocorrelation

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Abstract: Poyang Lake Eco-economic Zone is an eco-economic demonstration area in harmony between mankind and nature. It is an imperative to develop a green urbanization road with coordination and harmony between ecological civilization construction and economic and social development in a bid to effectively protect local ecological environment. By beginning with the basic connotations of green development, the evolution trend of green urbanization spatial pattern is revealed and the influences of ecological environment on evolution of spatial pattern in the research. By building comprehensive evaluation index of green urbanization development level, the green urbanization development level of 9 representative prefecture-level cities at Poyang Lake Eco-economic Zone from 2008 to 2014 is measured through entropy evaluation method. Besides, the in-depth analysis on evolution process of spatial pattern is carried out. Meanwhile, spatial autocorrelation test is carried out with Moran'sI index. From four perspectives such as economy, society, environment and social security, the influence factor variables are selected and analyzed by virtue of influences factors of spatial econometric model on spatial pattern evolution. According to the research, it manifests that green urbanization of Poyang Lake Eco-economic Zone shows high level aggregated distribution and high level area has the trend of spreading to the low level area. In addition, the area with good ecological environment also has high regional development level because of the great influence of ecological environment on spatial pattern.

Key words: *green urbanization; ecological environment; spatial pattern*

1. Introduction

Along with steady growth of national economy, great achievements in China' urbanization has been made through years' development. China's urbanization rate reached 52.57% in 2012, basically catching up with the world average level. The remarkable achievement in urbanization was fulfilled [1]. However, there are such issues as low China's urbanization efficiency, low urbanization construction level and excessive concentration of urbanization, etc. All these factors will be the internal motivation for the continuous robust development of urbanization. Accelerated development of urbanization will further give propel to the domestic investment and increase market vigor. In the meantime, the development of process of urbanization is also the one of gradually decomposing urban-rural dualistic structure, eliminating urban-rural disparity and realizing urban-rural integration. According to urbanization process curve proposed by the American scholar Northam (1979), China's current urbanization level is at accelerated development stage. No matter urbanization scale or urbanization speed, it has reached certain degree [2]. However, due to the rapid urbanization, a lot of populations are centralized in city. Thus, the urban load pressure is increased, specifically represented by insufficient professional skills, intensive urban dwelling space and imperfect living security systems including education and medical treatment. Besides, due to consumption of a lot of energies and increasingly prominent environmental problem, China is being faced up with severe resource and environmental pressure. According to the Central Economic Work Conference in 2012, it proposes that it is necessary to integrate ecological civilization philosophy and principle into overall urbanization process and go on intensive, green and low-carbon new-type urbanization road [3]. According to "National Plan on New Urbanization (2104-2020)"proposed by the government in 2014, it mentions that great efforts should be exerted to go on the road of new people-oriented, urbanization with Chinese characteristics featuring people first, synchronization of four modernizations, optimization layout, ecological civilization and cultural inheritance. The emphasis highlighted by the plan has already shifted to the direction of harmony between mankind and environment from the urban development [4].By exploring the development mechanism and realization path of green urbanization, development quality of green urbanization can be qualitatively evaluated. Besides, its development effectiveness also can be qualitatively monitored. As a result, it is of significant

theory and practice research value [5]. It is an imperative to go on the road of green development by taking ecological environmental protection as basic premise to solve problems about ecological environmental protection left by traditional urbanization development model.

Along with the ongoing urbanization process, the scholars both at home and abroad have carried out corresponding researches on problems about spatial patter evolution or urbanization. In middle and late period of last century, Australian scholar Moran proposed using Moran index for spatial correlation test [6], Getis proposed spatial correlation index based on spatial association distance and further promoted the development of partial spatial correlation [7]. These studies have paved solid foundation for those on urbanization spatial pattern in later stage. In China, the scholar (2015) carried out analysis and classification of spatial evolution of urbanization level through spatial correlation and also carried out driving factor analysis on various types of county regions through regression analysis [8]. Scholars Pan Jinghu and Liu Ying (2012) measured urbanization development level of Gansu Province through entropy evaluation method and also analyzed spatial pattern differentiation. Thus, they found that there was remarkable inter-regional correlation [9]. The scholar Yang Lulu (2015) carried out the analysis on spatial pattern evolution of urbanization quality of six provinces in the middle of China with the conclusion that there was large difference in urbanization quality among all provinces and the inter-regional urbanization shows aggregated distribution pattern [10]. The scholars Wang Yali and Peng Baofa (2013) carried out the analysis on spatial state of area about Dongting Lake. According to the research, it's found that agricultural modernization level had great influences on spatial variation of population urbanization of lake area [11]. The scholars Song Yuning and Han Zenglin (2013) measured the urbanization quality of old industrial area in the northeast and inferred the urbanization quality scale and relation among all cities in Liaoning province is unchanged but the degree of deviation among each was large [12]. The scholars Zhang Xiaojuan and He Yongjian (2011) built comprehensive level evaluation index system for urbanization of Qinghai province from three aspects such as population, economy and society, and found that the comprehensive level spatial distribution of Qinghai province features point-axial structure and fan-shaped distribution by relying on cluster analysis [13].

To sum up, the studies on spatial pattern of urbanization carried out by numerous scholars at home and abroad are still at preliminary stage while most are concentrated on spatial characteristics and differentiation of urbanization without involving the spatial pattern evolution and driving factor of green urbanization. In the meantime, under the guidance of green development core philosophy, the study on spatial pattern of green urbanization shall be shifted from the measurement of ecological environment index from that of indexes such as traditional economy and society. Therefore, it is necessary to study core philosophy based on green development for building comprehensive evaluation index system for green urbanization level, carry out study spatial pattern evolution of green urbanization of Poyang Lake Eco-economic Zone and build spatial econometric model for comprehensively analysis on driving factors of spatial pattern to provide theoretical basis and practice guidance for green urbanization road of Poyang Lake Eco-economic Zone.

2. Building spatial measurement model

2.1. Entropy method

Entropy evaluation method, an objective weighting method, determines index weight according to the size of information provided on the basis of observed value of various indexes [14]. According to the characteristics of entropy, the randomness and disorder degree of a scheme can be estimated through calculation of entropy. Besides, the dispersion degree of certain index can be estimated through entropy. The larger the dispersion degree of index, gives greater influences of the index on comprehensive evaluation. Therefore, the calculation of weight of various indexes based on information entropy according to the variation degree of various indexes provides basis for multi-index comprehensive evaluation. The step for calculating index weight based on entropy evaluation method is as below:

2.1.1. Data standardization treatment

Forward index standardization formula

$$x_{ij}^{'} = \frac{x_{ij} - \min\{x_j\}}{\max\{x_j\} - \min\{x_j\}}, i = 1, 2, \cdots, n, j = 1, 2, \cdots, m \quad (1)$$

Negative index standardization formula

$$x_{ij}^{'} = \frac{\max\{x_j\} - x_{ij}}{\max\{x_j\} - \min\{x_j\}}, i = 1, 2, \cdots, n, j = 1, 2, \cdots, m \quad (2)$$

2.1.2. Calculate the proportion of jth value in ith year into the index's value of the past years

$$P_{ij} = \frac{X_{ij}}{\sum_{i=1}^{n} X_{ij}} (i = 1, 2, \cdots, n, j = 1, 2, \cdots, m) \quad (3)$$

2.1.3. Calculate entropy of jth index

$$e_j = -k \sum_{i=1}^{n} P_{ij} \ln(P_{ij}) \quad (4)$$

2.1.4. Calculate variation coefficient of jth index

$$g_j = 1 - e_j \quad (5)$$

2.1.5. Calculate the weight of jth index

$$W_j = \frac{g_j}{\sum_{j=1}^{m} g_i} (j = 1, 2, \cdots, m) \quad (6)$$

2.1.6. Calculate ith year's green urbanization level exponent

$$S_i = \sum_{j=1}^{m} W_j P_{ij} \quad (7)$$

2.2. Spatial autocorrelation test

Traditional spatial data analysis method is built on the basis of mutually independent observed value. Therefore, it is necessary to choose statistical analysis spatial autocorrelation according to the different types of observed value of spatial data. Besides, I is necessary to choose Moran'sI index with the widest applications for test according to spatial distribution of 9 representative prefecture-level cities (counties) in Poyang Lake Eco-economic Zone, for which the calculation formula is as below

$$\text{Moran's}I = \frac{\sum_{i=1}^{n}\sum_{j=m}^{n} w_{ij}(x_i - \overline{x})(x_j - \overline{x})}{S^2 \sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}} \quad (8)$$

In which, n refers to the sample size, namely total number of cities, x_i and x_j indicate the observed values of i th and j th area respectively. W_{ij} indicates the distance between spatial location i and j; when i and j refer to the neighboring spatial locations, $W_{ij}=1$. Reversely, $W_{ij}=0$. The value range of Moran'sI index is [-1,1]. When I value is close to 1, it indicates that the similar observed values of two areas tend to be spatial agglomeration, showing positive spatial autocorrelation; when it is close to -1, it indicates that the similar observed values of two areas tend to be scattered distribution, showing negative spatial autocorrelation. When it is equal to 0, the observed values show independent distribution.

2.3. Choose spatial econometric model

In regression analysis on time series data, if regression model includes one or many lagged values of dependent variable in its explanatory variable, it indicates the spatial autoregressive model. Considering the green urbanization level of certain area may be influenced by other areas in spatial location, spatial autoregressive model is used to discuss whether the explanatory variable is influenced by that of surrounding area in one area [15].

$$Y_t = \alpha + \rho WY + \beta X + \varepsilon \quad (9)$$

In which, W indicates the spatial weight matrix of area. α refers to the constant term; β refers to the regression coefficient; ρ refers to spatial lagged auto regression coefficient; ε refers to the random disturbance, obeying independent identically distributed.

3. Analysis on spatial pattern evolution of green urbanization

3.1. Build evaluation index system

It's necessary to study core philosophies based on green development, refer to related data of "National Plan on New Urbanization (2014-2020)"proposed by the government in 2014 to build comprehensive evaluation index system for green urbanization level according to scientificity, comprehensiveness & comparability of evaluation and data available principle. The index system includes four aspects and total 20 indexes such as economic development, social development, external population relocation and eco-environment. For specific weight, please refer to the table 1.

Table 1: *Comprehensive Evaluation Index System for Green Urbanization Level*

Criterion Layer	Index Level	Weight
Economy	Per capital income (Yuan)	0.031
	Proportion of tertiary industry into GDP (%)	0.035
	Per capital fiscal expenditure (Yuan)	0.017
	Fixed asset investment (Yuan)	0.025
	Land output rate (%)	0.044
Society	Social insurance coverage rate (%)	0.032
	Unemployment rate (%)	0.042
	Per capital living area (m2)	0.021
	Book quantity/thousand people (1)	0.012
	Number of beds in hospital /thousand people (1)	0.018
	Highway density (km/km2)	0.027
	Mean year of education (year)	0.046
Population	Urban migration rate of external population (%)	0.055
	Urban employment rate of external population (%)	0.051
	Per capita living area of external population (m2)	0.054
	Enrollment rate of children of external population in public school (%)	0.043
	Social security coverage rate including pension, medical treatment and unemployment (%)	0.057
Ecological environment	Green area of built-up area/thousand people (m2)	0.048
	Green coverage rate (%)	0.087
	Unit GDP power consumption (kWh)	0.075
	Number of annual average good days of atmosphere in urban (day)	0.073
	Industrial wastewater discharge meeting standard rate (%)	0.051
	Contaminated gas discharge (t)	0.056

During the process of green urbanization, economic and social development level refers to the most direct

index for measuring traditional urbanization. However, along with ongoing urbanization, such problems as resource scarcity and environmental contamination have been increasingly highlighted. As a result, environmental governance appears exceptionally important. The data for the study is selected from "Jiangxi Statistics Yearbook" 2008-2014 and part of data is collected from official websites of National Bureau of Statistics of the People's Republic of China and Statistics Bureau of Jiangxi [17-18].

3.2. Empirical analysis on spatial pattern evolution

3.2.1. Calculate green urbanization level index

According to calculation steps of entropy evaluation method, calculate the green urbanization level indexes (table 2) of Poyang lake Eco-economic Zone in 2008, 2010, 2012 and 2014. It could be known from the table 2 that the green urbanization level indexes of Poyang lake Eco-economic Zone from 2008 to 2014 overall shows growth trend. Green urbanization of Poyang lake Eco-economic Zone not only manifests the increase in economic level but also shows the improvement and establishment of urban ecosystem. As a result, it further indicates that it's necessary to pay attentions to the protection of ecological environment to improve green urbanization development level.

Table 2: *Green urbanization Development Level Indexes of 9 Representative Prefecture-level Cities (Counties) of Poyang Lake Eco-economic Zone*

Prefecture-level Cities	2008	2010	2012	2014
Nanchang	0.721	0.724	0.719	0.736
Jiujiang	0.629	0.633	0.649	0.692
Jingdezhen	0.521	0.536	0.591	0.623
Guixi	0.503	0.511	0.522	0.537
Yushui	0.401	0.427	0.438	0.502
Dongxiang	0.429	0.442	0.453	0.489
Fengcheng	0.515	0.523	0.527	0.540
Poyang	0.417	0.420	0.434	0.446
Xingan	0.409	0.413	0.423	0.439

3.2.2. Spatial pattern of green urbanization of Poyang Eco-economic Zone

Green urbanization development level index of Poyang Lake Eco-economic Zone is the attribute data. The attribute data of prefecture-level cities (counties) is divided into four categories with GIS software through natural breaks in order to respectively draw the Figure for green urbanization development level pattern in 2008, 2010, 2012 and 2014 (Figure 1).

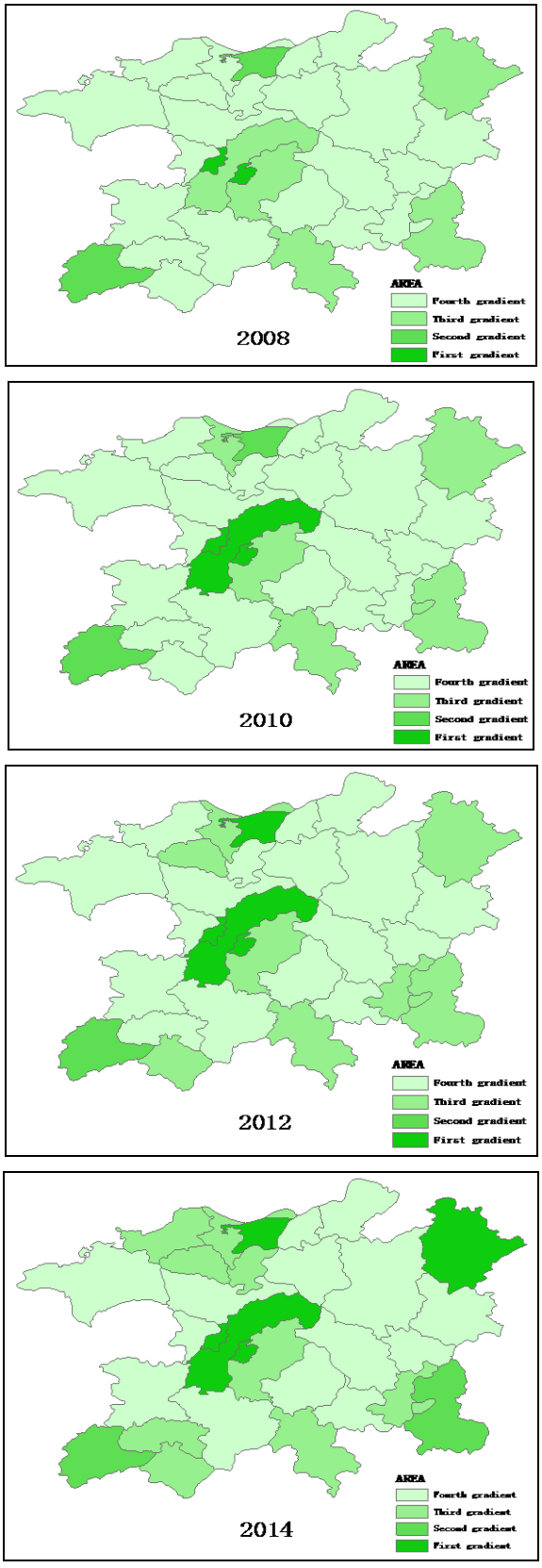

Figure 1: *Green Urbanization Development Level Pattern of Poyang Lake Eco-economic Zone in Different Years*

It could be found from the Fig. 1 that the areas in first gradient of green urbanization development in 2008

only include Nanchang; those in second include Jiujiang and Xinyu while the rest prefecture-level cities (counties) refer to the areas in third and fourth gradient. The green urbanization development level of Poyang Lake Eco-economic Zone is overall low and there is a great difference among areas, which are basically not mutually associated. There were some changes in spatial pattern of green urbanization development in 2010, in which the relative level of De'an and Nanchang was increased. The ecological environment of these areas was also improved to a certain extent. By relying on their development advantage, Nanchang and Jiujiang kept high green urbanization development level. Until 2012, the disparity in green urbanization development level across the whole province was certain reduced. The areas with high level still include Nanchang and Jiujiang. As the political and economic center of Poyang Lake Eco-economic Zone, Nanchang has always taken a leading role in green urbanization development. Nanchang has improved its green urbanization development level by taking a series of measures such as vigorously developing green new energy and encouraging new-type enterprises to have investment. In 2014, spatial pattern of green urbanization development of Poyang Lake Eco-economic Zone showed high-level regional agglomeration phenomenon. Nanchang and Jiujiang are taken as the core first-gradient areas in Poyang Lake Eco-economic Zone, which is also thanks to the related policy supports such as Nanchang-Jiujiang Integration. However, it also could be found that the green urbanization development level of most areas is low. Judged from the range of whole province, there is the trend that the development gap is further expanded.

4. Analysis on Influence Factors f Spatial Pattern Evolution

4.1. Spatial correlation analysis

Spatial econometric model, built based on regional interaction, measures relevancy and correlation degree among variables. It is necessary to implement spatial correlation test for the explanatory variable before building model. According to the development level index of green urbanization development level indexes of Poyang Lake Eco-economic Zone every year calculated above, it is necessary to implement significance test for green urbanization development level of 9 representative prefecture-level cities (counties) in Poyang Lake Eco-economic Zone in 2008, 2010, 2012 and 2014 with Geoda software respectively. For the test result, please refer to the Fig. 2. There is certain change in Moran's*I* index of green urbanization development level of 9 representative prefecture-level cities (counties) in Poyang Lake Eco-economic Zone from 2008 to 2014. However, their values are above 0.29 and pass through significance test. It indicates that there is spatial disorder distribution in green urbanization development level of all prefecture-level cities off Poyang Lake Eco-economic Zone but there is obvious spatial correlation. By combining the above-mentioned spatial pattern analysis, it could found that the green urbanization development level of 9 representative prefecture-level cities (counties) shows regional centralization. The green urbanization development of all prefecture-level cities is more associated. As a result, it manifests spatial correlation in green urbanization development level of Poyang Lake Eco-economic Zone across the whole province. To further analyze the influence factors of spatial pattern evolution, the spatial econometric model will be built in this paper.

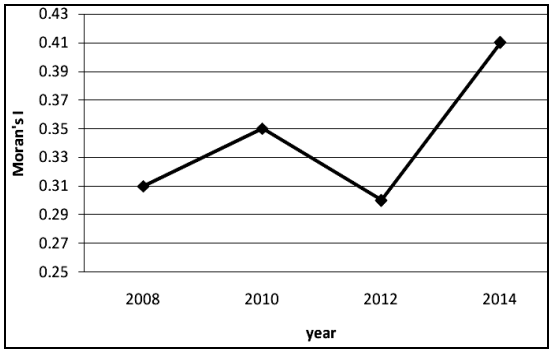

Figure 2: Moran's*I Index of Green Urbanization Development Level of 9 Representative Prefecture-level Cities (Counties) in Poyang Lake Eco-economic Zone in Each year*

4.2. Build spatial econometric model

According to dynamic analysis on spatial pattern evolution, it could be known that there exists obvious spatial agglomeration phenomenon in green urbanization development of Poyang Lake Eco-economic Zone from 2008 to 2014. This spatial agglomeration phenomenon manifests that green urbanization has already been no longer the simple process of transformation of agricultural population into urban population but the mutually influenced and facilitated dynamic evolution process integrating many aspects such as harmony between mankind and environment, economic development, social progress, ecological environment protection and scientific & technological innovation. Besides, the dynamic mechanism and driving factors it contains are also quite complicated. For this regard, green urbanization has already been not decided by one or two factors. The evolution of its spatial pattern will suffer from influences of multiple factors. To explore the influences on evolution of spatial pattern of green urbanization development and the role of these factors in evolution of spatial pattern, Cobb-Douglas production function will be introduced in this paper. As a kind of economic mathematical model for analyzing the industrial system of the state and region or production of large-sized enterprises and analyzing the pathways for development and production, multi-

factor regression analysis on the production function can be carried out.

Based on influence factors during traditional urbanization development process and combining green development connotations of the philosophy of harmony between mankind and environment, it could be known that the influence of spatial pattern evolution of green urbanization development shall be analyzed from four perspectives. Firstly, speaking of economy, economic strength shall be the significant factor influencing green urbanization development. It directly gives propel to the green urbanization construction. Industrial development level K and capital element investment L are selected as the explanatory variables for economic perspective. Secondly, speaking of society, the analysis on influence factors of green urbanization development shall include two aspects such as government's governance capacity E and infrastructure construction G. Thirdly, speaking of social security, it is the most significant perspective manifesting green development. It is an imperative to build perfect social security system to realize green urbanization development. Social security level F is selected as the explanatory variable. Lastly, speaking of environment, green urbanization development is realized in certain regional space. The environmental elements of this region including geology, hydrology, climate and resource have influences on evolution of spatial pattern. Greening situation S and resource usage W are selected as the explanatory variables for environmental perspective. Then, the explanatory variables have already been selected for all perspectives. Therefore, the influence factor analysis model of green urbanization development can be built according to Cbb-Dougla s production function [19]:

$$Y = AK^{\beta_k} L^{\beta_l} E^{\beta_e} G^{\beta_g} F^{\beta_f} S^{\beta_s} W^{\beta_w} \quad (10)$$

In which, Y refers to the explained variable, namely the green urbanization development level of 9 representative prefecture-level cities (counties) in Poyang Lake Eco-economic Zone. A indicates overall technical level of production function; β indicates parameters to be estimated. To facilitate calculation, it is necessary to take logarithm for the two end of formula (10), and then the spatial econometric model of formula (11) will be obtained.

$$\begin{aligned} \ln Y_{it} &= \alpha_{it} + \beta_k \ln K_{it} + \beta_l \ln L_{it} + \beta_e \ln E_{it} \\ &+ \beta_g \ln G_{it} + \beta_f \ln F_{it} + \beta_s \ln S_{it} \\ &+ \beta_w \ln W_{it} + \varepsilon_{it} \end{aligned} \quad (11)$$

In which, ε_{it} indicates random error item of independent and identical distribution. For i and t, it's necessary to satisfy zero-mean covariance σ^2. To make each explanatory variable easy to be measured, it's necessary to observe the principles of data acquirability and convenience. For industrial development level, it's necessary to select the proportion of secondary industry into total GDP value (%). For capital element input, it's necessary to select urban fixed asset investment (0.1 billion Yuan). For governmental governance capacity, it's necessary to select the proportion of government expenditure into GDP (%). For infrastructure construction level, it's necessary to select the proportion of urban road area (%). For resource usage, it's necessary to select urban per capita coal resource consumption (ton). The data of abovementioned variables is collected from statistics yearbook of Poyang Lake Eco-economic Zone, government's annual fiscal report and official website of Statistics Bureau of Jiangxi.

4.3. Empirical analysis

4.3.1. Spatial regression analysis

Spatial correlation test has proved that the green urbanization development level of 9 representative prefecture-level cities (counties) in Poyang Lake Eco-economic Zone possesses obvious spatial correlation. It possesses agglomeration phenomenon in spatial distribution. To effectively estimate the influence factors of spatial pattern evolution, it is firstly necessary to implement quantitative analysis on spatial panel data and carry out regression analysis on influence factors of green urbanization development level of 9 representative prefecture-level cities (counties) in Poyang Lake Eco-economic Zone through Eviews and Matlab2010b based on regressive econometric model of spatial panel from 2008-2014, as shown by the table 3.

Table 3: *Regression Analysis on Spatial Econometric Model*

	Estimated Result Ⅰ	**Estimated Result Ⅱ**	**Estimated Result Ⅲ**
Variables	OLS	SLM	SDM
K	0.0234*** (4.1548)	0.0123*** (3.2487)	0.0319*** (5.5742)
L	0.0513*** (11.3689)	0.0249*** (5.8974)	0.0073*** (7.3574)
E	0.0497*** (13.1248)	0.0517*** (24.1863)	0.0671*** (15.2879)
G	0.0648*** (10.2394)	0.0371** (3.0670)	0.0519*** (2.6492)
F	0.0144** (4.5792)	0.0205*** (5.4937)	0.0273*** (7.2475)
$\rho(\lambda)$	-	0.5548*** (16.0342)	0.5369*** (16.5498)
R^2	0.5490	0.2371	0.7839

Note*: data in bracket refers to the* t *statistics of corresponding estimators. *, **and ***indicate 10%, 5% and 1% significance level.*

It could be seen from the result of regression analysis that various variable indexes in estimation result of OLS model passes through significance test. Besides, it could be known from estimation parameter that urban security level has greatest influences on explained variables followed by social and economic

development level. The abovementioned analysis on spatial pattern evolution has verified that green urbanization development possesses spatial correlation. Therefore, the result of OLS estimation might be biased or invalid under the circumstance that the spatial factors are neglected based on which it's necessary to carry out estimation of spatial autocorrelation model and spatial Dubin model (SDM). It could be known from the final estimated result in the table that the spatial autocorrelation coefficient of two spatial econometric models is positive value and passes through significance, which also directly manifests the positive influences of the development of surrounding prefecture-level cities on green urbanization development of certain prefecture-level city. Through analysis from the perspective of element change, spatial pattern evolution of green urbanization development level can be regarded as the process of element agglomeration and dispersion, during which the elements including capital, population and resource are gradually transferred along with the evolution of spatial pattern. By combining the abovementioned analysis result, it could be known that the dispersion effect of element will be further improved due to the existence of spatial correlation in green urbanization development among prefecture-level cities. As a result, green urbanization development of Poyang Lake Eco-economic Zone is expanded to the surrounding areas from high-level areas such as Nanchang and Jiujiang. Meanwhile, spatial agglomeration role among all prefecture-level cities will also develop their advantages and work closely gradually to mutually facilities their green urbanization development.

4.3.2. Influence factor

According to the analysis on spatial pattern evolution of green urbanization of Poyang Lake Eco-economic Zone, it could be known that the first gradient areas of green urbanization level are also just those with high economic development level and ecological environmental index, which is corresponding to the core philosophy of green development. The influence factors of spatial pattern evolution of green urbanization of Poyang Lake Eco-economic Zone can be analyzed from social and environmental perspectives.

Influence factors in social perspective include two aspects; government governance capacity and infrastructure construction. It could be seen from the estimated result that the estimation parameter of government governance capacity is positive value. It indicates that the government has strong governance capacity, which will be favorable for facilitating green urbanization development. The government plays a significant role in many aspects such as regulating market order, balancing allocation of resource elements an attracting external investment. However, all these will have direct influences on green urbanization development. However, through result analysis on lagged items added to SDM model, it could be known that the parameter of government's governance capacity is negative value. It manifests that the governments at all levels overprotect the development of their local regions, thus it is not favorable for green urbanization development within the province. Infrastructure construction, the content required for urbanization development, is the first condition of urbanization construction. The parameters of infrastructure construction of two estimation models are positive value, manifesting the positive facilitating on green urbanization development. Infrastructure includes many aspects such as road, bridge, public buildings and cultural entertainment places. It is necessary pay heeds to the construction of infrastructure to realize green urbanization development with harmony in mankind and environment, which is also the premise and guarantee for improving residents' living quality.

Ecological environment problem has been increasingly serious along with the gradually deepened process of urbanization, which is the resulted from no attentions paid to environmental protection during urbanization development. It could be seen from the estimated result that the estimation parameter of urban green environment is above 0.11 and passes through significance test. It thus indicates that urban green environment plays a positive role in facilitating green urbanization development. During the development of 9 representative prefecture-level cities (counties) of Poyang Lake Eco-economic Zone, Nanchang and Jiujiang attach importance to the development of green economy. The urban green area accounts for a large proportion in urban planned area. As a result, the green urbanization development is facilitated to a greater extent. However, estimated values of estimation parameter of resource usage in two models are negative values, which indicate that the consumption of resource has already been the barrier for sustainable and sound development of urbanization.

5. Conclusions

Based on the study on guidance of green development philosophy with the core ecological environmental protection and by building comprehensive evaluation index system for green urbanization development level, it is necessary to measure green urbanization development level of 9 representative prefecture-level cities (counties) in Poyang Lake Eco-economic Zone from 2008 to 2014 and carry out in-depth analysis on evolution of its spatial pattern. It is thus concluded: on one hand, the spatial pattern of green urbanization development shows agglomeration trend, areas with high economic level, complete infrastructures and urban environment have high development level and also has the trend that the central zone is dispersed towards surrounding areas. On the other hand, inter-regional green urbanization development possesses significant spatial correlation, which is mainly

manifested by relative concentration of high-level areas. It could be known through calculation of spatial econometric model that industrial development level, capital element input, government's governance capacity, infrastructure construction and good ecological environment play a positive role in facilitating green urbanization development but in impeding resource usage.

Poyang Lake Eco-econometric Zone has good ecological environment. It is necessary to follow core philosophy of green development to achieve urbanization development of this region. In the meantime, it is also necessary to have scientific and effective guidance and shift the development speed that is pursued for urbanization to the green urbanization road with emphasis on development quality. It is the inevitable choice for China to promote green urbanization process by sticking to the core ecological environmental protection of green development philosophy and go on the road of coordinated and unified ecological civilization construction and social &economic development.

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