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Spatial Differences of Environmental Pollution and Environmental Regulation Based on Social Network Analysis

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Abstract: The concept of green development is deeply rooted in the hearts of the people, and it has become the norm to attach importance to environmental pollution control. However, resources, production factors, historical development, pollution levels and management intensity are different in different regions of China, and there are great differences in environmental pollution management in different regions. The purpose of this paper is to study the spatial differences and environmental regulation of environmental pollution based on social network analysis. Firstly, the mechanism of environmental regulation in our country is analyzed theoretically. This paper introduces the definition and characteristics of social network analysis, and studies the spatial difference governance of environmental pollution based on social network analysis. The factor analysis method is used to measure the comprehensive index of environmental regulation intensity and make inter-provincial comparisons. Through the global spatial autocorrelation test and local spatial correlation analysis of environmental regulation intensity in each province, the spatial characteristics of inter-provincial environmental regulation intensity are discussed. Through empirical research, it is found that from the perspective of spatial distribution, the spatial accumulation of environmental pollution in my country is obvious, the spatial dependence of environmental pollution is gradually strengthened, and the spatial distribution of environmental regulation is positively correlated.

1. Introduction

Under the new normal, severe environmental pollution has become one of the main obstacles to

building a beautiful China and building an ecological civilization. Among them, the aggravation of environmental pollution not only restricts the sustainable development of the economy, but also affects the normal life and health of the public, which has attracted the attention of the public and policy makers. How to optimize the environmental regulation mechanism and comprehensively use different types of environmental regulation tools to effectively prevent environmental pollution and improve environmental quality has important scientific and practical significance [1].

On winter nights, wood smoke can be a major source of air pollution even in cities with many sources of pollution. Tunno B's spatial saturation stratified by time detected strong spatial variability across the study area, with clear daytime versus nighttime spatial and temporal differences, and quantified the effect of substantial contributing soot on nighttime spatial variability of PM2.5 across Christchurch . The difference between day and night is greater than the difference between individual sites. Traffic flow, especially diesel, contributes significantly to the daytime NO2 content and the spatial gradient of non-smoky components [2]. The South Atlantic (SWA) is affected by industrial and agricultural activities, which are major sources of pesticides and PCBs. Diaz-Jaramillo M assessed nonspecific differences in OCP and PCB levels at different scales in the benthic polychaete Laeonereis culveri from SWA rivers. Concentrations of OCPs/PCBs were associated with animal body weight, but this covariate was not associated with the observed differences [3]. Therefore, in a long period of time in the future, how to determine the optimal development model and realize the coordinated development of economy and environment is a major problem that needs to be solved in future development [4-5].

This paper analyzes the changing trends and regional evolution of water, air and solid waste pollution in my country. Based on social network analysis, the countermeasures for the governance of environmental pollution spatial differences are discussed. Starting from the evolution of my country's environmental regulation policies, this paper measures the environmental regulation intensity index of each province, and examines the spatial relationship of inter-provincial environmental regulation. On this basis, the global spatial autocorrelation test of environmental pollution and the global spatial autocorrelation test of environmental regulation intensity are analyzed.

2. Research on Spatial Differences of Environmental Pollution and Environmental Regulation Based on Social Network Analysis

2.1. My Country's Environmental Regulation

The environmental regulation system is established on the basis of the principle of "unified management and classification, and coordination between different departments", and is gradually deepened and improved with the practice of market-oriented reform, economic development, environmental problems and pollution control practices[6-7] . As shown in Figure 1, the environmental regulation system can be understood from the two dimensions of "horizontal" and "vertical": relevant environmental protection departments and other relevant institutions take the lead in operating "top-down" and implement "stipulation management"; Responsible for the environmental quality of the jurisdiction and the implementation of "block management". As the highest administrative organ of the country, the State Council exercises equal command over the Ministry of Ecology and Environment and other relevant departments[8-9]. As an agency directly under the State Council, the Ministry of Ecology and Environment is responsible for the formulation, implementation and enforcement of environmental monitoring work based on environmental policies, plans and standards. People's governments at all levels are responsible for

the management and responsibility of environmental protection work within their respective jurisdictions. The general offices of local, municipal and local people's governments are responsible for supervising the coordination and management of environmental protection work in their respective regions.

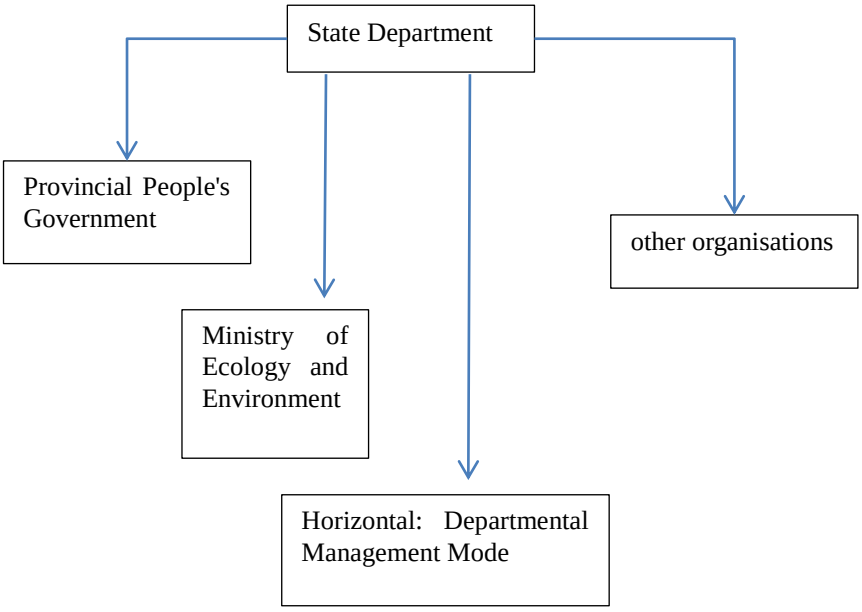

Figure 1. Schematic diagram of the environmental regulation system

2.2. Social Network Analysis

The social network analysis method has been relatively mature in the field of management. It not only provides a research tool for academia to analyze various management problems, but also reflects a relational way of thinking. Explaining the social structure of a given network from the perspective of "relationship" provides a new analytical perspective for research problems [12].

First, social network analysis is to explain the behavior of node actors according to the constraints of network structure on node actors; second, the research perspective of social network analysis is the relationship between actors, not the intrinsic attributes of actors; third, social network analysis The relational nature of the social structure involved in network analysis is significantly different from the independent variables required by conventional statistics; fourth, the relational pattern between members in social network analysis is not limited to two-dimensional relations, but has relations with multidimensional factors Patterns affect the behavior of network members and how they affect them. Fifth, social network analysis regards social organizations as networks in networks, that is, networks are hierarchical, and networks may or may not belong to specific groups [13-14].

2.3. Spatial Difference Governance of Environmental Pollution Based on Social Network Analysis

(1) Regulate and guide elite groups

First, it promotes centrality mobility and reduces the negative influence of elite dominance. The

long-term dominance of elite groups will lead to an invalid situation in which "individual interests" are greater than "collective interests". Through the flow and transformation of point centrality, intermediate centrality and near centrality, the risk of elite authority domination can be reduced, and the negative effects of elite domination can be reduced. Influence, and curb the expansion of elite group's self-interested behavior. Second, establish a central flow mechanism to unblock the channels of capital, information and technology dissemination [15]. On the one hand, we need to publicize and persuade several key nodes in a targeted manner, so that they can effectively drive the demonstration role of pollution control. On the other hand, we need to fully mobilize people with high intermediate and close centrality. Promote the dynamic transformation of different degrees of centrality in the chain [16].

(2) Cultivate a social network of diverse cooperation

Diversified cooperation is built on the basis of high general trust in the society, and is a process of cooperation that is characterized by moderate scale, rich resource composition, and large relationship composition, and ultimately aims at public interests. Utilize the dissemination and expansion of the relationship network to convey environmental rights and interests information to the people and increase the enthusiasm of the people to participate. The entry of political forces is not excluded in the formation of multi-cooperation procedures. Instead, appropriate government leadership is required and a better institutional environment is provided., so as to standardize the elements in the social network [17].

(3) Coordinate the interests and needs of multiple subjects

Under a good social network platform, through the effective and reasonable leadership of elite groups, the coordination of interests and needs of multiple subjects needs to run through the entire process of aquaculture pollution control [18]. On the basis of fully considering the interests of various subjects, it is necessary to speed up the formation of a public participation model. Different forms and targeted guides for individual participation with different degrees of centrality. The governance under the elite social network model is ultimately the rule of man, which cannot be used for a long time. It is necessary to restrict the governance model of informal institutions through institutions, and public participation is the most effective normative means.

3. Investigation and Research on Spatial Differences of Environmental Pollution and Environmental Regulation

3.1. Investigation Method

This paper selects the total pollutant discharge indicators of 20 provinces and municipalities from 2018 to 2021, namely the total discharge of industrial wastewater, the discharge of chemical oxygen demand of industrial wastewater, the discharge of industrial smoke and dust, and the discharge of industrial wastewater. The treatment method adopts the solid waste and factor analysis method to calculate the total environmental pollution index. Among them, soot emissions and dust emissions have been combined into soot emissions from 2019, and soot emissions in previous years are expressed as the sum of soot emissions and dust emissions. Using the spatial data analysis method, the global Moran index of spatial autocorrelation is used to test this distribution pattern and analyze its dynamic changes.

3.2. Environmental Regulation

Select the urban industrial wastewater, industrial sulfur dioxide, and industrial smoke and dust

emission indicators at the prefecture level and above for weighted calculation. The calculation formula is as follows:

$$pr_{li} = \frac{p_{li}}{\frac{1}{n}\sum_{j=1}^{n} p_{li}} \tag{1}$$

$$reg_i = \frac{1}{3}(px_{1i} + px_{2i} + px_{3i}) \tag{2}$$

In formula (1), the numerator pli represents the GDP share emission of L pollution in city i, and px1i, px2i and px3i represent the emission levels of primary, secondary and tertiary pollution in city i, respectively. The larger the calculated regi value, the lower the environmental regulation level of city i, and the smaller the regi value, the higher the environmental regulation level of city i.

4. Analysis and Research on Spatial Differences of Environmental Pollution and Environmental Regulation

4.1. Global Spatial Autocorrelation Test of Environmental Pollution

The Moran index of the comprehensive level of environmental pollution was calculated using the comprehensive index of inter-provincial environmental pollution in my country from 2018 to 2021. The results are shown in Figure 2. If the Moran value is between 0 and 1, then the observations in each region show a positive spatial correlation. The closer the Moran value is to 1, the stronger the positive spatial correlation between regions. If the Moran value is close to 0, there is no spatial correlation between regions, and if the Moran value is between 0 and -1, it indicates that there is a negative spatial correlation between regions. It can be seen from Table 1 that the Moran index of the intensity of environmental regulation is positive, and passed the 4% significance level test in 2018 and 2019, and the Moran value in other years is also significant at the 8% level, which shows that my country There is a significant positive correlation in the spatial distribution of environmental pollution in 31 provinces and cities, that is, there is a phenomenon of spatial agglomeration of environmental pollution in my country. From 2018 to 2021, the Moran value gradually increases, which means that the spatial dependence of environmental pollution is further strengthened.

Table 1. Moran index table of environmental pollution 2018-2021

Years	Moran	Z value	P value
2018	0.23	1.88	0.02
2019	0.28	1.76	0.02
2020	0.29	1.45	0.05
2021	0.31	1.50	0.06

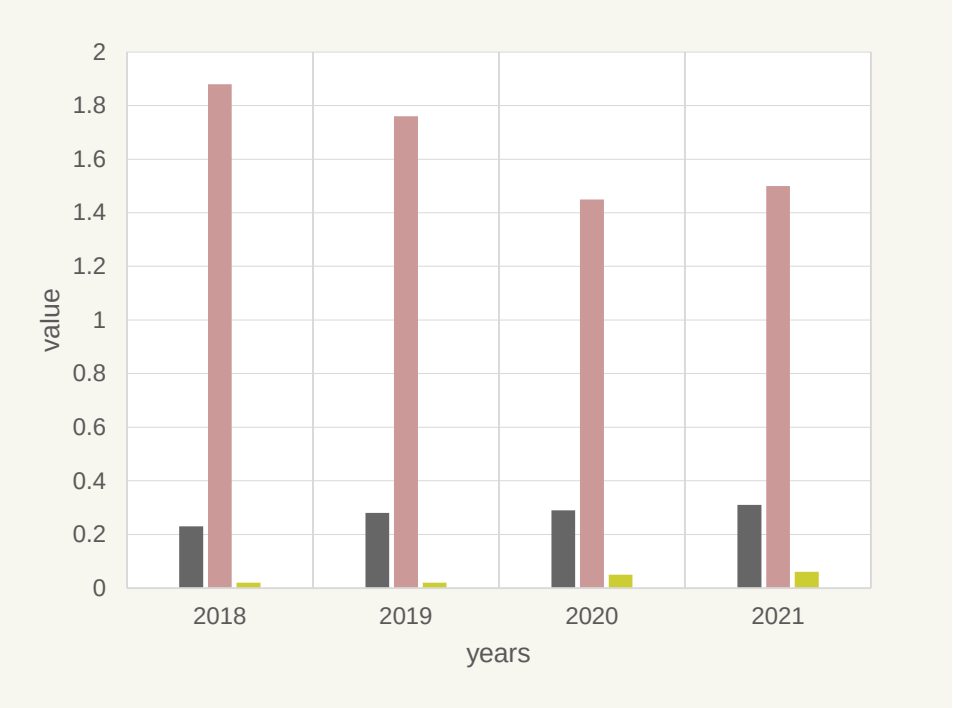

Figure 2. Global spatial autocorrelation test results of environmental pollution

The agglomeration areas with relatively serious environmental pollution show a trend of shrinking to the north and extending to the east, while the agglomeration areas with relatively light environmental pollution have expanded from the original northwestern provinces to the southwestern and central provinces. The degree of spatial aggregation of environmental pollution in my country has further increased.

4.2. Global Spatial Autocorrelation Test of Environmental Regulation Intensity

Spatial autocorrelation can be tested with Moran's index. Table 2 shows the Moran index of the intensity in each province from 2018 to 2021. It can be seen that the Moran index is positive. Except for 2018, which passed 8%, all other years passed the 4% significance level test, as shown in Figure 3. It shows that the spatial distribution in our province has significant positive correlation and significant spatial dependence.

Table 2. Moran index table of inter-provincial environmental regulation intensity in 2018-2021

Years	Moran	Z value	P value
2018	0.25	2.55	0.06
2019	0.33	2.86	0.02
2020	0.37	2.77	0.01
2021	0.38	2.89	0.02

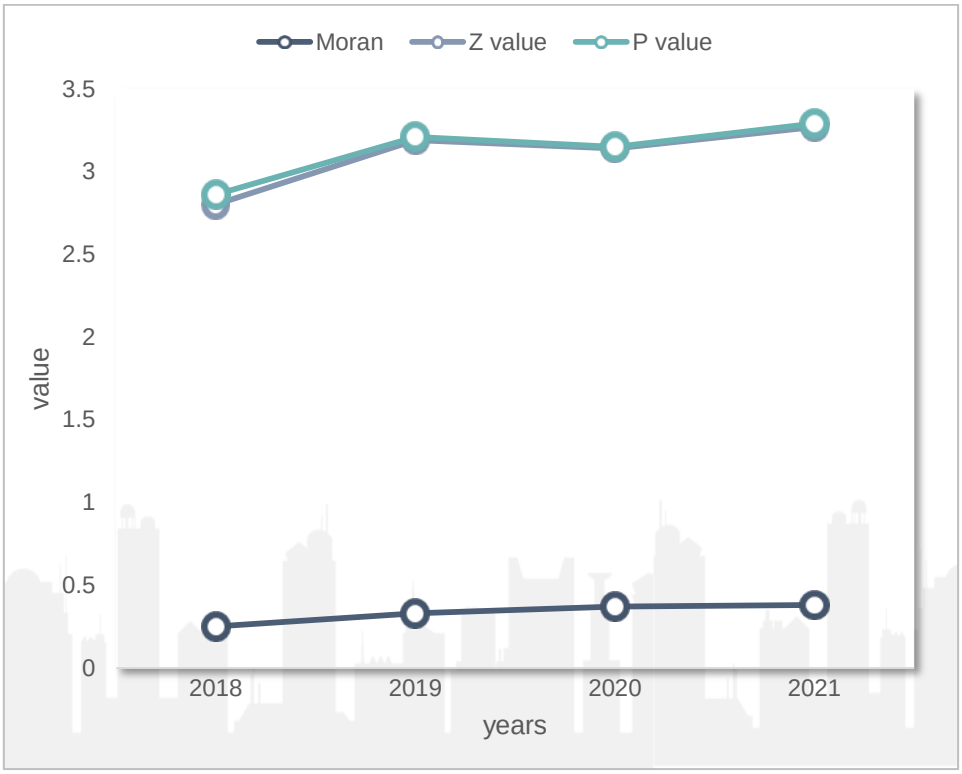

Figure 3. Global spatial autocorrelation test results of environmental regulation intensity

The high-value agglomeration areas of environmental regulation intensity show a trend of further expansion from the eastern coastal areas of my country to the central inland areas, and the degree of spatial aggregation in my country further increases. The low-value clusters of environmental regulation intensity are still mainly concentrated in the western region, but there are also significant differences among provinces. With the further strengthening of environmental regulation in my country, the trend of transition from low environmental regulation intensity to high environmental regulation intensity will become more and more obvious in the provinces in the central region and even some provinces in the western region.

5. Conclusion

Environmental Pollution Accompanying Economic Growth How to reduce environmental pollution while economic growth is a hot research topic in academic circles. Based on the current regional differences between regional environmental pollution and environmental regulation in my country, this paper deeply discusses the impact, and conducts scientific research on regional differences in environmental pollution governance based on social network analysis. Although this paper has done some theoretical and empirical analysis on the premise of referring to a large number of literatures and collecting relevant data, and has drawn some practical conclusions, there are still shortcomings in the research due to the constraints of time and ability. The main manifestations are as follows: further investigate the impact of the cumulative effect of industrial agglomeration in different regions on the environmental effect; theoretically, a theoretical model of environmental regulation and regional environmental pollution differences with stronger explanatory power can be constructed.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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