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Air Pollution Control Based on Ecological Compensation and Financing Mechanism

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Abstract: At present, with the rapid development of my country's economy and the acceleration of the process of urban integration, various environmental pollution problems such as dust pollution, vehicle exhaust pollution, and open burning are frequent, and the problem of air pollution control is particularly prominent. The purpose of this paper is to study air pollution control based on ecological compensation and financing mechanism. The construction of my country's air pollution control ecological compensation fund system is mainly discussed from the aspects of legislative construction, specific system construction, fund type, fund source, fund use and payment, compensation scope, level setting, etc., and analyzes the operation of the air pollution ecological compensation fund system. principle. The improvement suggestions are put forward from two aspects: strengthening the supervision of the ecological compensation fund for air pollution control and improving the use efficiency of the ecological compensation fund for air pollution control. According to the research results, most of the heavy-industry-led cities and service-oriented cities have achieved the goal of green economic growth, and with the increase of per capita GDP, the concentration of PM2.5 has gradually decreased.

1. Introduction

Ecological and environmental problems are closely related to the unbalanced, insufficient and unsustainable economic and social development of our country. At present, my country has built a moderately prosperous society in an all-round way, but to achieve high-quality economic development in my country, we must solve the shortcomings of the ecological environment [1-2]. In the previous economic development and ecological governance model, China implemented a gradient-promoted non-balanced development governance strategy, focusing on high-quality

resources to develop regions with higher returns, and then developing regions to drive other regional economies, and the same is true for environmental governance [3-4]. This development model has promoted the rapid economic growth of some regions in my country, but the use of this governance model has objectively increased the gap in governance effectiveness between different regions [5]. The mutually beneficial and complementary relationship between the contributors and the beneficiaries of the construction of ecological civilization cannot be guaranteed, the beneficiary areas evade compensation obligations, the contributing areas are not compensated, and the distribution of regional benefits has major deviations, which seriously hinders the development of ecological civilization in my country. Construction, atmospheric governance has entered a critical area [6].

Bark may be an important indicator of arsenic and heavy metal air pollution. Patel K S sampled road dust at 13 sites and found As, Cr, Mn, Cu, Zn and Pb concentrations in 165-329, 107-151, 704-998, 43-84, 61-117 and 26 are in the range of -62 mg kg~(-1), respectively. The sensitivity of bark of 32 tree species widely distributed in the research field was evaluated for its use as a biological indicator and the correlation between road dust and pollutant content in bark was calculated [7]. Mello K D assessed how different strategies (on-site/off-site conservation and/or restoration), and the different requirements for ecological equivalence when using off-site strategies, affect the ability to achieve statutory protected area targets while minimizing the need for Restore native vegetation on productive farmland. We use a novel iterative tool to construct scenarios reflecting different combinations of strategies to meet minimum conservation goals under different ecological equivalence requirements, and compare their ability to achieve goals and possible costs [8]. Only by focusing on the problem itself, can we find optimized and perfect methods and countermeasures to promote the effectiveness of air pollution control [9].

This paper conducts an empirical analysis on the solution to the problem of "compensation standard" - "the economic cost of air pollution control for cities in different stages of industrialization". This paper discusses the relationship between air pollution concentration and various social and economic variables under different urban industrialization development stages, and analyzes the influence of factors such as per capita GDP, industrial structure, and population density on air pollution concentration in different types of cities. This paper summarizes the law of the economic cost of air pollution control in the stages of industrialization development, and distinguishes the economic pressure for air pollution control in different stages of industrialization development, so as to provide a reference for calculating the amount of ecological compensation for air pollution control.

2. Research on Air Pollution Control Based on Ecological Compensation and Financing Mechanism

2.1. The Necessity of Implementing Ecological Compensation for Air Pollution Control

(1) Necessary means to balance the interests of the regional atmospheric ecological environment

The atmospheric environment carrying capacity in a certain area is limited. When the pollutant discharge exceeds the atmospheric environment capacity and self-regulation ability of the area, it will destroy the atmospheric ecological environment and cause atmospheric pollution. The atmosphere has strong fluidity, and pollutants diffuse to other nearby areas, causing pollution to the atmospheric environment in other areas [10]. Conversely, if the quality of the atmospheric environment in this area is improved, the quality of the atmospheric environment in other nearby areas will also be improved to a certain extent. The control of air pollution in areas with good

atmospheric environmental quality sacrifices the economic and social interests of the region, while areas with relatively good atmospheric environmental quality enjoy benefits without paying any cost, which is inconsistent with the concept of fairness and justice in environmental interests. The implementation of regional ecological compensation is conducive to solving this vicious circle, and the ecological benefits generated by the high-quality atmospheric environment can be balanced and coordinated in different regions [11].

(2) The inevitable demand for improving the ecological compensation system

Ecological compensation has achieved remarkable research results after years of development in my country, but most of the results are concentrated in forests, grasslands, cultivated land, mine environment management and ecological restoration, etc. The results in the field of air pollution control are not bright enough and solid. The deeper reasons This is due to the nature of air mobility and many influencing factors, and it is difficult to implement governance at the technical and operational levels [12]. In addition, because the legal mechanism of ecological compensation for air pollution control is a new system proposed in recent years, there is currently a relatively lack of research on ecological compensation in the field of air pollution control. Studying the ecological compensation system in the field of air pollution control will enrich and improve my country's ecological compensation system[13-14].

2.2. Framework of Ecological Compensation Mechanism

The framework of ecological compensation mechanism refers to a complete framework of ecological compensation mechanism design, which is used to guide the implementation practice of ecological compensation projects [15]. Generally speaking, the design of ecological compensation mechanism generally involves such elements as ecological compensation participants, compensation standards, compensation conditions, compensation modes, funding sources and payment methods, as shown in Figure 1.

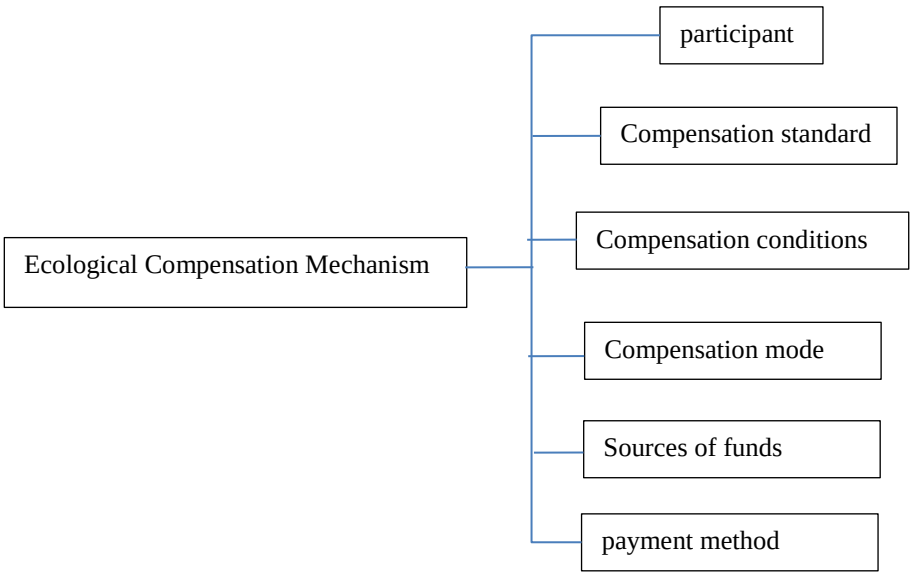

Figure 1. Framework of ecological compensation mechanism

Ecological compensation standard, that is, the size of the specific ecological compensation amount [16]. The payment to a service provider in a PES plan must be less than the value of the

service to the user (otherwise the compensation does not make economic sense) and not less than the cost of the service provided by the service provider (otherwise the provider does not provide the service). Therefore, how to evaluate the opportunity cost of environmental service provision and the benefit of service use is the key to determine the compensation standard [17-18].

Ecological compensation conditions refer to the specific basis for the implementation of compensation payment behavior. The design of the ecological compensation mechanism must specify the conditions for compensation payment. In general, the specific payment conditions of ecological compensation can be divided into two categories: output-based payment and input-based payment. Output-based payment conditions refer to a compensation method that measures the value of ecological services according to the indexation method specified in the contract and pays compensation accordingly, which is also commonly called result-based (or performance-based) payment.

The payment method of ecological compensation refers to the specific payment method of the ecological compensation standard (compensation amount), including cash payment and non-cash payment. Because the needs of ecological service providers are different, the compensation payment methods for different ecological service providers are often different.

2.3. Financing Mechanism for Air Pollution Control

(1) Environmental PPP project

PPP financing model is short for public-private partnership. Under this model, in order to save public resources or maximize the efficiency of public resources, the government takes advantage of private resources and adopts a public-private partnership to jointly develop, build, maintain, and operate a financing model. The cooperation method can be equity cooperation or contractual cooperation. Through public-private partnership, the utilization efficiency of public resources can be maximized. At the same time, the introduction of private enterprises to supervise public projects can also improve the management efficiency of administrative operations. It is a financing model with great promotion potential. It can not only achieve a win-win situation, but also improve efficiency. It is a financing issue of global significance. The financing of environmental protection PPP projects has the characteristics of general project financing, and has a large demand for funds. After stable operation is achieved, environmental protection PPP projects generally have the characteristics of stable cash flow and long payback period.

(2) Green Fund

An important advantage of green funds is that they can combine different financing means and tools to form different financing schemes. Green funds also include private equity funds, which only raise funds for a specific minority of investors; the sales and redemption of private equity funds rely on private negotiation and are based on private trust; private equity funds are not allowed to advertise publicly in order to attract social unspecified Investors; the regulatory environment for private equity funds is relatively loose, as long as it does not violate existing laws, the government generally does not impose strict restrictions; private equity funds do not have strict information disclosure requirements and have high security; private equity funds respond quickly to the market and have very flexible operations space.

3. An Empirical Study on the Exploration of Air Pollution Control Based on Ecological Compensation and Financing Mechanism

This paper selects the annual average PM2.5 concentration, per capita GDP, secondary industry

proportion and population density data of 100 cities in my country from 2019 to 2021. Among them, there are 20 energy-oriented cities, 20 heavy industry-oriented cities, 20 light industry-oriented cities, 20 high-tech-oriented cities, and 20 service-oriented cities. The PM2.5 data comes from the atmospheric composition analysis group of a university; the urban per capita GDP, secondary industry proportion and population density data are all extracted from the urban statistical yearbooks of various cities over the years.

The panel smooth transition regression (PSTR) model was selected to analyze the relationship between air pollution, economic development and industrialization. The PSTR model is a suitable choice for addressing heterogeneity, nonlinearity, and threshold effects. Standard PSTR models include several smooth transition mechanisms determined by transition variables. A standard PSTR model with m+1 mechanisms can be expressed as:

$$y_{i,t} = \mu_i + \beta_0^{'} x_{i,t} + \beta_1^{'} x_{i,t} g(q_{i,t}, \gamma, c) + \varepsilon_{i,t} \quad (1)$$

$$g(q_{i,t}, \gamma, c) = [1 + \exp(-\gamma \prod_{j=1}^{m} (q_{i,t} - c_j)]^{-1} \gamma > 0, c_1 < ... < c_m \quad (2)$$

where i=1, ..N, t=1,..., T; N represents the sample, T represents the time, and Yit is the explained variable.

4. Analysis and Research on the Exploration of Air Pollution Control Based on Ecological Compensation and Financing Mechanism

4.1. Model Specification Test

The first step is to test whether there is a nonlinear mechanism transfer effect in the model data. This step is to determine the nonlinear relationship between the explanatory variables and the explained variables. It can be seen from Table 1 that the five types of cities have passed the nonlinear test., at the 0.9% significance level, the null hypothesis is rejected, indicating that there is a significant nonlinear relationship between the per capita GDP, industrial structure, population density and PM2.5 of these five types of cities, as shown in Figure 2. Analysis can be performed with the PSTR model, as shown in Table 1.

Table 1. Nonlinear tests of the model

City type	Number of transfer mechanisms=1	Number of transfer mechanisms=2
Energy-led city	9.6	20.7
Heavy industry-led city	5.2	18.8
Light industry-led city	27.5	37.4
High-tech-led city	17.8	18.4
Service city	10.3	12.1

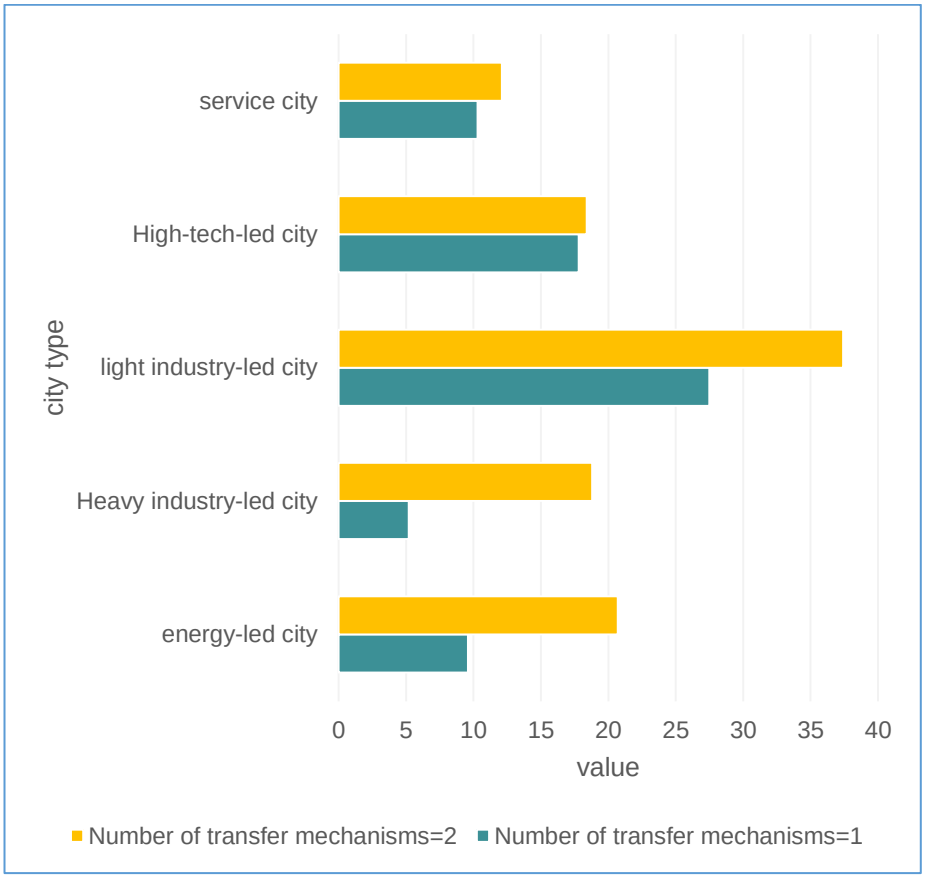

Figure 2. Test model data

After testing for nonlinearity, we proved that there is at least one transition variable in the PSTR model. The question that needs to be solved now has changed from "Is there a nonlinear relationship?" to "Is there a residual mechanism?" First, start from H0:r=1 and the alternative hypothesis H1:r=2 to test whether the model rejects the null hypothesis, if If it cannot be rejected, it means that the model has only one conversion function, r=1; if the null hypothesis is rejected, continue to test H0:r=2, and repeat the previous test steps until the test quantity cannot strongly reject the null hypothesis. At this point, the number (r) of transfer functions of the PSTR model can be determined.

The residual mechanism test of the five types of cities shows that there is another conversion function for light industry-dominated cities, and there is only one conversion function for the other four types of energy-dominated, heavy industry-dominated, high-tech-dominated and service-oriented cities.

4.2. Analysis of Results

Table 2 summarizes the corresponding transfer variables, transfer function values, and variable coefficients for the five types of cities under different mechanisms. As shown in Figure 3, from the results, the PSTR models of energy-oriented, heavy-industry-oriented, high-tech-oriented and service-oriented cities all show two mechanisms; the light industry-oriented city model shows a low mechanism, two The three-mechanism status of the high mechanism.

Table 2. Results of the PSTR model

City type	GDP per capita	Industrial structure	Population density
Energy-led city	0.76	-15.75	-1.19
Heavy industry-led city	0.87	5.68	-0.84
Light industry-led city	15.77	-31.21	-0.99
High-tech-led city	0.07	0.23	0.79
Service city	-0.86	21.87	-0.07

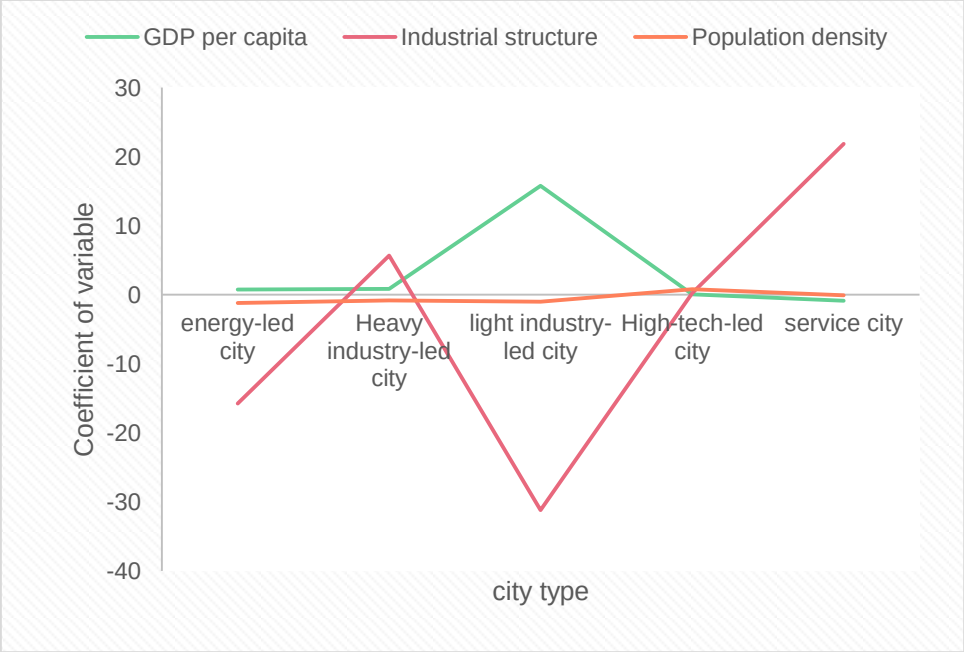

Figure 3. Variable coefficients for five types of cities

Most of the cities dominated by heavy industry are located in high-level mechanisms, and their economic development has crossed the inflection point of "environmental EKC". With the growth of per capita GDP, the concentration of PM2.5 has gradually decreased. Most of the cities dominated by light industry are located in the low mechanism and the first high mechanism, the economic growth is still in a relatively extensive mode, and the social and economic development is at the expense of the environment to a certain extent. And compared with other types of cities, the internal heterogeneity of light industry-led cities is more obvious. Most of the high-tech-led cities are in the external mechanism, basically realizing the decoupling of air pollution and economic development. About one-half of service-oriented cities are located in the inner mechanism. Service-oriented cities not only achieve decoupling of air pollution and economic development, but also have great potential to achieve green development.

5. Conclusion

Promoting the construction of ecological civilization, building a modern environmental governance system, building a new pattern of harmonious coexistence of green, environmental protection, and circular economy and nature, and realizing the harmonious coexistence and

sustainable development of man and nature are major strategic measures of the country. This paper takes the air pollution control of five types of cities as the research object. The main atmospheric environment, control site, and governance model are typical in the whole country. This paper adopts the air pollution control of five types of cities The work is systematically analyzed, researched, and demonstrated, so that it has better pertinence and persuasion. In the next step, on the basis of this article, it will be realistic, closely focus on the changes in air pollution control, and actively conduct in-depth refinement, demonstration and analysis, and strengthen the guidance and guidance of emerging public management theories for ecological environmental protection, construction, and restoration. effect.

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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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