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Study on Characteristics and Influencing Factors of Air Pollution

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Abstract. Beijing-Tianjin-Hebei region, the capital economic circle of our country, is a serious polluted area at present. Under the coordinated development of this strategy, it is of great significance to explore the characteristics and influencing factors of air pollution in Beijing-Tianjin-Hebei region. In this paper, the characteristics of Beijing-Tianjin-Hebei air pollution are analysed by descriptive statistics, and the main factors affecting Beijing-Tianjin-Hebei air pollution are obtained by regression analysis based on the characteristics of Beijing-Tianjin-Hebei region.

Keywords: Air Pollution; Energy Consumption; AQI; Efficiency.

1. Introduction

With the rapid development of the global economy and the acceleration of urbanization, the characteristics of urban air pollution have changed from a single one.The soot-type pollution has been transformed into a compound type of pollution. Beijing-Tianjin-Hebei iron and steel industry, automobile industry is relatively developed, is an important national heavy industrial base, and heavy industry needs to consume a large amount of energy; And located in the north, the main energy comes from coal combustion, and coal combustion is more than other energy sources of air pollutants, Beijing-Tianjin-Hebei area has a large number of cars, automobile exhaust has gradually become one of the important pollution sources in the region. These are the important causes of air pollution in Beijing-Tianjin-Hebei region, resulting in air pollutants in this region are often higher than the national average level. Serious air pollution has damaged not only the image of the country, but also the human body. Health, become one of the important factors of social disharmony.

2. Air Pollution Characteristic Analysis

PM2.5 is the primary pollutant of air pollution in the Beijing-Tianjin-Hebei region, and is the most important culprit of haze weather. In 2013, (IARC), an international research institute on cancer, listed PM2.5 as a human carcinogen. The Beijing-Tianjin-Hebei urban agglomeration is the core area of China's economy and an important region reflecting the national competitiveness, and its coordinated development has risen to the national strategy. In the outline of the Beijing-Tianjin-Hebei Collaborative Development Plan, it is pointed out that the first breakthrough should be made in the area of ecological and environmental co-governance. The problem of air pollution in Beijing-Tianjin-Hebei urban agglomeration has become the focus of the current government, academia, the public and the media.

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What are the characteristics of air pollution in Beijing-Tianjin-Hebei urban agglomeration is the focus of this part of the study. There have been a lot of studies on the influencing factors of air pollution: population concentration, industrial production, coal, petroleum and energy consumption, automobile exhaust are the main sources of air pollution; Different levels of urbanization, speed of economic growth, industrial structure, energy use structure and efficiency, land use types, traffic conditions, urban forms and other effects on urban air quality are also different. For natural factors, a large number of studies have shown that meteorological elements play an important role in air pollution, including air temperature, precipitation, and humidity. Degree, air pressure, wind speed, wind direction and so on have important influence on air pollution.

2.1. Situation Analysis

The main mechanism of joint prevention and control of Beijing-Tianjin-Hebei air pollution is a long-term strategic cooperation mechanism established between the Beijing Municipal Government, the Tianjin Municipal Government and the Hebei Provincial Government. The main body of this area is divided by the central government in the Twelfth five-year Plan of Air pollution Prevention and Control in key regions. In terms of geographical location, Hebei Province surrounds Beijing and Tianjin; at the administrative level, Beijing, Tianjin and Hebei Province belong to the same administrative level; in leadership, the three regions do not have the relationship between leadership and being led.

The implementation of Beijing-Tianjin-Hebei coordinated development strategy is of great significance to the innovation of regional development system and mechanism, the cultivation of new growth poles and the optimization of regional development pattern. Over the past five years, the economy of the Beijing-Tianjin-Hebei region has been steadily improving, people's livelihood has been continuously improved, and progress has been made in an orderly manner; transport construction, environmental protection, and industrial upgrading have achieved remarkable results in three key areas, and a new pattern of regional development has been formed.

In 2017, the total output of the Beijing-Tianjin-Hebei region reached eight trillion two hundred and fifty six billion yuan, with an average annual growth rate of 7.5 percent over the past five years. Revenue from the general public budget reached one trillion ninety seven billion four hundred million yuan, an average annual growth of 8.9 percent over the past five years, and the urbanization rate reached 65.0 percent, an increase of 6.0 percentage points from 2012. In 2017, the proportion of the tertiary industry in Beijing, Tianjin and Hebei was 58.6%, 21% higher than that of the secondary industry, according to regional characteristics, their own advantages and functional positioning, actively adjusting the structure, changing the mode of development, and speeding up the development of the dominant industries, and the industrial structure was more reasonable. 9 percentage points, 7.8 percentage points higher than in 2012. Beijing, Tianjin and Hebei continue to increase efforts to control high energy consumption and high pollution enterprises, establish regional air pollution joint prevention and control mechanism, and jointly promote energy conservation and consumption reduction work.

2.2. Pollutant Discharge Analysis

The following table shows the emissions of pollutants from the three regions of Beijing, Tianjin and Hebei:

Table 1. Beijing-Tianjin-Hebei Pollutant Emissions Unit: Ten Thousand tons

Year	Area	Coes	Cocl	Cock	Coco	Cogs	Coks	Codo
2013	Beijing	6724	2019.23	0.79	870.92	423.61	477.06	193.9
2013	Tianjin	7882	5278.67	955.48	1759.15	212.24	56.12	324.65
2013	He bei	29664	31663.27	8339.85	1385.89	347.55	17.59	800.57
2014	Beijing	6831.23	1736.54	0.64	1034.62	440.62	507.58	196.46
2014	He bei	29320.21	29635.54	8127.2	1356.61	314.64	17.59	788.8
2014	Tianjin	8145.06	5027.28	954.39	1603.17	226.82	59.85	334.43
2015	Beijing	6853	1165.18	0.44	991.54	462.75	544.38	182.35
2015	Tianjin	8260	4538.83	904.69	1616.72	263.73	65.78	353.43
2015	He bei	29395	28943.13	7726.45	1666.82	475.32	8.24	749.18
2016	Tianjin	8245	4230.16	887.29	1433.6	274.49	82.02	370.35
2016	Beijing	6962	847.62	0.21	821	470.37	594.27	172.69
2016	He bei	29794	28105.65	8079.49	1761.93	494.86	29.46	843.59

Total energy consumption:

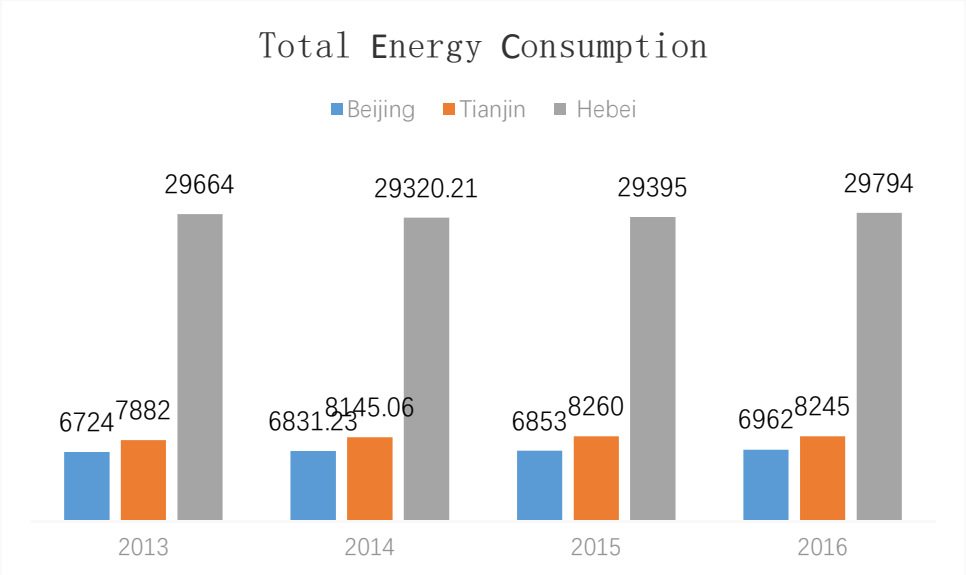


Figure 1. Total Energy Consumption

The total energy consumption of Hebei Province is the first in the past four years, which indicates that the pollution of Hebei Province is more serious than that of Beijing-Tianjin-Hebei region. Hebei Province should speed up environmental governance to better promote the concept of green development.

2.3. AQI Index Analysis

In order to measure the air pollution situation, this paper downloads the monthly AQI statistics from 2014 to 2018 in Guotai'an database, and makes descriptive statistics. The results are as follows:

Table 2. Description Statistic

	N	min	max	mean value	standard deviation	skewness		kurtosis	
AQIIndex	587131	5	500	81.79	49.145	2.978	.003	15.844	.006
Valid N	587131								

It can be seen from the above table that the maximum value of AQI is 500 and the minimum value is 5, which indicates that the environmental pollution in different regions of our country is quite different, the average value is 81.79, which indicates that the overall situation of environmental pollution in China is better.

In order to better study the situation of environmental pollution in Beijing-Tianjin-Hebei region, the statistical results of environmental pollution in Beijing-Tianjin-Hebei region are as follows:

Table 3. Description Statistic

	N	min	max	gentle	mean value	standard deviation	variance	skewness		kurtosis	
AQIIndex	3608	23	500	396333	109.85	1.067	64.109	4109.967	1.813	.041	4.873	.082
Valid N	3608											

According to the above table, the maximum value of AQI in Beijing-Tianjin-Hebei region is 500, which indicates that the most polluted cities in China are concentrated in Beijing-Tianjin-Hebei region, and the average value is 109.85, which indicates that the pollution prevention and control in Beijing-Tianjin-Hebei region is imminent.

3. Analysis of Influencing Factors of Environmental Pollution

3.1. Model Building

In order to find out the factors that affect the air pollution control efficiency in Beijing-Tianjin-Hebei region, this paper constructs a panel model which takes the air pollution control efficiency as the explained variable and the related control variable as the explanatory variable to estimate and test the influencing factors. The form of the model is asfollows: $Y_{it} = \alpha_0 + \alpha_1 I_{it} + \alpha_2 GDP_{it} + \alpha_3 P_{it} + \alpha_4 L_{it} + \alpha_5 G_{it} + \alpha_6 H_{it} + \zeta$

In formula α_0 as a constant, I is the upgrading of the industrial structure, GDP is the gross domestic product, P is the technological innovation, L is the urban land expansion, G is the automobile exhaust emission, and H is the amount of investment in pollution control. In order to make the results more reliable and standardized before demonstration, the data are derived from the China Urban Statistical Yearbook and Guotai'an Database.

3.2. Empirical Analysis

In order to avoid heteroscedasticity by taking logarithm of all variables data before regression, the following table shows the results of empirical analysis of panel data in Beijing-Tianjin-Hebei region.

Table 4. Regression result

variable	regression coefficient	P value	VIF
Ln I	0.426	0.000	2.072
Ln GDP	0.097	0.000	1.97
Ln P	0.190	0.000	1.821
Ln L	-1.051	0.000	1.121
Ln G	-0.928	0.002	1.946
Ln H	0.535	0.000	
(constant)	0.018	0.000	
Adjust R-side	0.647		

The results of the model show that: (1) the upgrading of industrial structure has no significant effect on the air pollution control efficiency in Beijing-Tianjin-Hebei region. In 2015, the industrial structure of the Beijing-Tianjin-Hebei region continued to optimize, from 6: 42: 52 in 2013 to 5.5: 38.4: 56.1. Beijing has formed a stable pattern of "three-two-one" industrial structure, Tianjin and Hebei are "two-thirty-one"-type industrial structure. Therefore, the fine optimization of industrial structure does not significantly improve the efficiency of air pollution control. (2) Technology Technological innovation also has no significant impact on the efficiency of air pollution control, which indicates that patents in the region have not played a role in the treatment of air pollution in recent years. The achievements of environmental science and technology innovation have not been transformed into environmental protection ability and environmental protection patents have not been fully converted into productive forces, which makes technological innovation have no effect on the efficiency of air pollution control.(3) the influence of automobile exhaust emissions on the efficiency of air pollution control is remarkable, which indicates that after entering the 21st century, (4) there is a significant positive correlation between the amount of investment in pollution control and the efficiency of air pollution control at the level of 1%. This indicates that the current investment in environmental pollution control in Beijing, Tianjin and Hebei has significantly changed the air pollution. In addition, there is little correlation between regional GDP and air pollution control efficiency. In order to achieve the balance of urban scale, the links between Beijing, Tianjin and Hebei are strengthened, and joint efforts are made to control the environment.

4. Conclusion

To implement the strategy of Beijing-Tianjin-Hebei cooperation to protect the atmospheric environment, it is necessary to carry out the top-level design and scientific planning according to the strategic orientation of Beijing-Tianjin-Hebei region. In order to highlight the role of Hebei Province as a supporting area of Beijing-Tianjin-Hebei ecological environment, Beijing and Tianjin should work together towards a common goal in their respective positioning. On this basis, Beijing, Tianjin and Hebei provinces and regions to strengthen consultations, there are matters to be discussed. Through the consultation among governments, Beijing, Tianjin and Hebei firstly formulate the strategy of misplaced development according to the comparative advantage to avoid duplication of construction, waste of resources and damage to the ecological environment.

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