Domestic Garbage Disposal and Environmental Protection Financial Pressure — Empirical Analysis Based on Provincial Data of China

Jingjing Li [1, a]

[1] Grier School, 2522 Grier School Road, Tyrone, Pennsylvania, 16686, US;

[a] lilyleeht123gmail.com

Abstract. This paper analyzes the impact of domestic waste on regional environmental protection expenditure. Based on the annual data of each province from 1999 to 2018 released by the "National Bureau of statistics of the People's Republic of China", a multiple linear regression model was used for empirical analysis. The result shows that there is a positive correlation between the amount of domestic waste and environmental protection expenditure, and the pressure coefficient on regional finance is between 0.112 and 0.198. In addition, relevant elements of the classical Kuznets curve are tested in this paper, which also provides necessary data support for domestic waste classification and treatment policies.

Introduction

In the half century after the reform and opening up, China's economy has achieved rapid and sustained growth, but in the process, environmental pollution problems have begun to appear and become increasingly severe. With the introduction of "green GDP", the Chinese economy has begun to turn to the New Normal development, placing environmental protection and economic development on an equally important position. In the analysis of environmental protection issues, the existing research mostly focuses on the treatment of industrial pollution. In fact, the pollution problem caused by domestic garbage is also serious and direct. In this context, it is of great practical significance for this paper to analyze the impact of household garbage treatment on local environmental protection expenditure. On one hand, it analyzes the financial pressure coefficient of domestic garbage in each region, and on the other hand, it provides data to support for the necessity of new measures for domestic waste disposal. Different from the previous research, this paper uses the combination of theoretical analysis and empirical analysis to explore the relationship between domestic waste and environmental protection expenditure, and carries out heterogeneity analysis based on regional related characteristics.

Literature Review

The cause of environmental pollution and its control has been a hot topic in the field of environmental science. Ying Xie (2009), in his article "Empirical Study on the Relationship between Environmental Indicators and Economic Growth", analyzed the relationship between the concept of sustainable development and economic growth by using the Kuznets curve. The author used data from mainland provinces in "China Statistical Yearbook" for regression analysis. The author found that economic growth increases environmental pollution and therefore requires a combination of policies to reduce pollution and promote economic development. Houqiang Yu (2009) analyzed the relationship between environmental pollution degree and human income in his article "Study on the Relationship between Environmental Bearing Threshold Environmental Quality and EKC". Based on theoretical model analysis and literature analysis, the author concluded that there is no environmental bearing threshold in the Kuznets curve. The geographical area of the study needs to have economic implications. Therefore, effective policies are essential to reduce environmental pollution in the process of economic growth. Hongxia Gao et al (2012) in their

article "Research and Prediction of the Relationship between Economic Growth and Environmental Pollution in China's Provinces", analyzed whether the data of Chinese provinces formed an "inverted U" shape with respect to the Kuznets curve and EKC model, and predicted the inflection point of emission of waste gas and sulfur dioxide. Based on the data of 31 provinces (cities and autonomous regions) in "China Statistical Yearbook" from 2000 to 2009, the author conducted empirical analysis based on the method of panel data. The results showed that the regional development in China is unbalanced, and some pollutants cannot decrease with economic growth. Therefore, the government needs to play a guiding role in making policies to reduce high pollution from enterprises.

In addition, considering the dominant position of enterprises in the market economy, the existing literature also analyzes the responsibilities of enterprises in environmental protection and governance. Yuan Wang and Ru Liu (2019) analyzed the relationship between the nature of corporate ownership, environmental pollution and economic development in their article "Authority of Ownership, Empirical Analysis of the Relationship between Environmental Pollution and Economic Development". Based on the "Wind" database and the "China Statistical Yearbook", authors used entropy weight method to calculate the environmental pollution index and used an empirical model for analysis. The results show that compared with non-state-owned enterprises, state-owned enterprises can better bear with environmental responsibility, and state-owned enterprises in the central and western regions have a positive impact on economic growth; and there is an inverted U-shaped relationship between environmental pollution and economic development. Fangrunya Liu (2019) analyzed the impact of network capacity on improving coal enterprise innovation under the influence of external environmental dynamics in his article "Empirical Research on the Impact of Network Capacity on Coal Enterprise Innovation under Environmental Dynamics". The author used a structural equation model and a Hraman one-factor test to analyze valid data based on 203 anonymous questionnaires. It was found that environmental dynamics can affect network capabilities and promote technological innovation and management of coal companies. Dengfeng Cui and Bowen Li (2019) studied the relationship between environmental regulation, marketing capabilities and technological innovation in their article "Research on the Impact Mechanism of Environmental Regulation on Enterprise Technology Innovation". Authors used the data of 128 heavily polluting listed companies in the Shanghai-Shenzhen A-shares from 2011 to 2015 for empirical analysis. It was found that marketing ability has a positive impact on enterprise technology innovation and mediates between environmental regulation and enterprise technology. In addition, internal marketing capabilities such as the board of directors can provide new ideas for regulating environmental regulations and corporate technology innovation. Fan Wang (2014) analyzed the sources of FDI and its impact on sustainable development in China in his article "FDI Sources and Sustainable Development in China". The author used the Data Envelopment Analysis Model (DEA) to analyze the provincial panel data from 2006-2009 in the "China Statistical Yearbook". It is found that there is a regional difference in the relationship between FDI sources and regional sustainable development. Therefore, each region should formulate a differentiation policy based on the optimal demand for FDI.

Model and Data

Model

This paper uses a multiple linear regression model to analyze the relationship between domestic waste treatment and regional environmental protection expenditures. Multiple linear regression models are commonly used to analyze multivariate perturbation problems, where the explained variables in a problem are affected by multiple independent variables. The cost of environmental protection expenditure is affected by many factors such as environmental pollution status, regional economic development level and population. Under such circumstances, it is particularly important to establish a multiple linear regression model by means of econometrics, and to accurately define

the impact of the amount of domestic waste on regional environmental protection expenditure among many influencing factors. The specific model form is shown in equation (1).

$$yi = \beta0 + \beta1xi + \beta2zi + u \tag{1}$$

In equation (1), the dependent variable is the regional environmental protection expenditure, and the independent variable x is the amount of domestic waste removal. The coefficient $\beta1$ represents the degree of influence of domestic waste removal on regional environmental protection expenditure. In order to accurately understand the pressure of domestic garbage removal on regional finance, this paper adds a series of control variables z in equation (1), including regional budgetary expenditures, industrial pollution control expenditures, population and regional GDP. In the estimation process of the model, this paper uses the least squares method in the mathematical optimization technique to find the best function matching of the parameters by minimizing the sum of the squares of the errors. The least square method can simply be used to obtain the estimated parameters, and the sum of the squares of the errors between obtained parameters and actual parameters is minimized. According to the Gauss-Markov theorem, the least squares estimator is a linear unbiased estimator with the smallest variance given the assumption of classical linear regression. Therefore, when classical assumption is established, there is no need to look for other unbiased estimators, and none will be superior to the ordinary least squares estimator. That is, if there is a good linear unbiased estimator, the variance of this estimator is at most as small as the variance of the ordinary least squares estimator and will not be smaller than the variance of the ordinary least squares estimator.

Data

Data used in this paper is derived from official statistics published by the National Bureau of Statistics. 1The data coverage is 31 provincial administrative units (provinces, municipalities and autonomous regions) in mainland China. The data spans from 1999 to 2000 for a total of 20 years. From the content of the variables of the data, in addition to the environmental protection expenditures and the amount of domestic waste removal in the main research variables, it also includes the regional fiscal status, the control variables of industrial pollution control, and the population and the level of social economic development GDP. In the process of data processing, this paper unifies the units of variables, and also fits the missing data by interpolation. According to the data collation, the sources and channels are official and authoritative, and the content can meet the needs of this paper.

Analysis and Conclusion

Analysis of Results

In Table 1, the dependent variable is the regional environmental protection expenditure, and the independent variables include the amount of domestic garbage removal, fiscal budget expenditure, industrial pollution control expenditure, population and regional GDP.

Table 1. Coefficient Results of Multiple Linear Regression Models

Variable name	(1) Environmental expenditure	(2) Environmental expenditure	(3) Environmental expenditure	(4) Environmental expenditure
Domestic garbage removal volume (10,000 tons)	0.169***	0.112***	0.198***	0.155***
	(0.0108)	(0.0196)	(0.0162)	(0.0269)
Budgetary expenditure (100 million yuan)	0.0292***	0.0476***	0.0280***	0.0153***
	(0.00205)	(0.00492)	(0.00557)	(0.00289)
Industrial pollution control expenditure (100 million yuan)	0.0695	-0.456*	0.234	0.510***
	(0.137)	(0.260)	(0.163)	(0.169)
Population (10,000 people)	0.0237***	0.0365***	0.0207***	0.0232***
	(0.00112)	(0.00312)	(0.00203)	(0.00161)
Gross regional product (100 million yuan)	0.000202	-0.00169*	-0.000606	0.00255***
	(0.000479)	(0.000964)	(0.00140)	(0.000934)
Constant term	6.270	-22.17**	20.78*	20.58***
	(4.702)	(9.216)	(11.26)	(4.387)
Sample size	337	121	88	117
R-square	0.967	0.967	0.965	0.978

Standard errors in parentheses*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Column (1) of Table 1 reports the regression results for all provinces in the country. From the national average situation, there is a significant positive correlation between the amount of domestic garbage removal and regional environmental protection expenditure. The increase in the amount of domestic garbage removal significantly increases the financial pressure on local environmental protection expenditure. The average pressure coefficient is 0.169. This means that for every 10,000 tons of domestic waste, the local government's environmental protection expenditure will increase by an average of 16.9 million yuan. Factors that have a significant impact on regional environmental protection expenditures include fiscal budget expenditures and population. Column (2) reports the regression results of the provinces in the eastern region. From the average situation in the eastern region, there is a significant positive correlation between the amount of domestic garbage removal and regional environmental protection expenditure. The increase in the amount of domestic garbage removal significantly increases the financial pressure on local environmental protection expenditure. The average pressure coefficient is 0.112. This means that for every 10,000 tons of domestic waste, the local government's environmental protection expenditure will increase by an average of 11.2 million yuan. Factors that have a significant impact on regional

environmental protection expenditures include fiscal budget expenditures, industrial pollution control expenditures, population, and regional GDP.

Column (3) of Table 1 reports the regression results of the provinces in the central region. From the average situation in the central region, there is a significant positive correlation between the amount of domestic garbage removal and regional environmental protection expenditure. The increase in the amount of domestic garbage removal significantly increases the financial pressure on local environmental protection expenditures. The average pressure coefficient is 0.198. This means that for every 10,000 tons of domestic waste, the local government's environmental protection expenditure will increase by an average of 19.8 million yuan. Factors that have a significant impact on regional environmental protection expenditures include fiscal budget expenditures and population. The column (4) reports the regression results of the provinces in the western region. From the average situation in the western region, there is a significant positive correlation between the amount of domestic garbage removal and regional environmental protection expenditure. The increase in the amount of domestic garbage removal significantly increases the financial pressure on local environmental protection expenditure. The average pressure coefficient is 0.155. This means that for every 10,000 tons of domestic waste, the local government's environmental protection expenditure will increase by an average of 15.5 million yuan. Factors that have a significant impact on regional environmental protection expenditures include fiscal budget expenditures, industrial pollution control expenditures, population, and regional GDP.

Conclusion

First of all, the results of the multiple linear regression model show that from the situation of eastern, central and western regions, the volume of domestic waste removal will bring financial pressure on regional environmental protection expenditures, and the correlation coefficient is between 0.112 and 0.198. Secondly, from the perspective of sub-regions, the analysis of the correlation coefficient between domestic waste removal volume and regional environmental protection expenditure in eastern, central and western regions also verified the existence of the classical Kuznets curve. Specifically, the eastern region represents a situation in which the economy is developed and the environmental pollution pressure is low; the central region represents a situation in which economic development and environmental pollution are high; and the western region represents a situation in which the economy is underdeveloped and environmental pollution is low. Finally, the relationship between the amount of domestic waste removal and regional environmental protection expenditure is also restricted by the regional socio-economic characteristics. The increase in budgetary expenditures and population will strengthen this relationship, and the impact of other environmental protection expenditures such as industrial pollution control and regional GDP growth will depend on the stage of regional economic development.

Suggestions and Prospects

Suggestions

From the perspective of environmental pollution control, this paper studies the influencing factors of environmental protection expenditure, focusing on the impact of the amount of domestic waste on environmental protection expenditure. Combined with the results of empirical analysis, this paper believes that: First, it is necessary to pay attention to the impact of the amount of domestic waste on environmental protection expenditures, and take effective measures to solve the problem of domestic garbage disposal, in order to alleviate the pressure on environmental protection fiscal expenditures. Secondly, it should be forward-looking in dealing with the quantity of household garbage and the expenditure of environmental protection. The development status of the eastern, central and western regions is located in the three stages of the Kuznets curve, which means that the successful experience of the eastern region in treating domestic waste can be used for

reference in the central and western regions, so as to avoid "pollution first, treatment later" in the central and western regions. Finally, in the process of dealing with the amount of domestic waste and environmental protection expenditures, it is necessary to meet the needs of people to improve their quality of life, as well as consider the real constraints of the stage of economic development and financial ability.

Outlook

At the same time, it should be noted that due to the limitation of data structure, this paper uses a comparative static analysis method in the process of analyzing the amount of domestic waste and environmental protection expenditure. In fact, the environmental and financial impact of domestic waste on the area is likely to be a long-term process. Based on the subsequent acquisition of more abundant data, this paper will establish a dynamic model for more accurate estimation.

References

[1] Fan Wang. *FDI Sources and China's Sustainable Development——Also on the Reality of the Pollution Shelter Hypothesis*[J]. Journal of Shanxi University of Finance and Economics, 2014(12).

[2] Fang Runya Liu. *Empirical study on the impact of network capacity on coal enterprise innovation under environmental dynamics*[J]. Coal Engineering, 2019(6).

[3] Feng Cuideng, Bowen Li. *Research on the Influence Mechanism of Environmental Regulation on Enterprise Technology Innovation——Based on China's Heavy Pollution Industry Empirical Test of Listed Companies* [J]. Journal of Shihezi University (Philosophy and Social Sciences), 2019(6).

[4] Hongxia GAO, Lin Yang, Haidong Fu. *Research and Prediction of the Relationship between Economic Growth and Environmental Pollution in China's Provinces——An Empirical Analysis Based on Environmental Kuznets Curve*[J]. Journal of Regional Economics, 2012(1).

[5] Houqiang Yu. *Research on relationship between environmental bearing threshold, environmental quality and EKC* [J]. Statistical Education, 2009(8).

[6] Ying Xie. *Empirical relationship between environmental indicators and economic growth Research* [J].Journal of Guangzhou University (Social Science Edition), 2009(10).

[7] Yuan Wang, Ru Liu. Empirical Study on the Relationship between Ownership Nature, Environmental Pollution and Economic Development [J]. 2019(6).