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Research on the Impact of Environmental Regulations on Green Economic Growth: Comparative Analysis Based on Resource-Based Cities and Non Resource-Based Cities

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Abstract
Green economic growth is an inevitable requirement for achieving coordinated development between China's economy and environment, and also an important way to achieve sustained and healthy economic development. Environmental regulation, as an important means of solving environmental problems, can internalize the negative externalities of environmental pollution generated in the production and operation process of enterprises, promote industrial structure adjustment and resource allocation optimization, and thereby promote the optimization of resource allocation, affecting economic growth. On the basis of sorting out the relationship between environmental regulation and green economic growth, this article takes panel data of 281 prefecture level cities in China from 2006 to 2020 as the research object, and divides them into two groups: resource-based and non resource-based cities. The GMM method is used to explore the quantitative relationship between environmental regulation and green economic growth. The results indicate that for both resource-based and non resource-based cities, environmental regulations significantly promote regional green economic growth, and environmental regulations have a greater promoting effect on green economic growth in resource-based cities.

Key words: Environmental regulation; Green economic growth; resource-based cities

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INTRODUCTION
China has a large number and wide distribution of resource-based cities, making significant historical contributions and standing out in reality. There are a total of 118 resource-based cities in China's prefecture level cities, accounting for about 18% of the total number of cities in the country. Since the founding of the People's Republic of China, resource-based cities have produced a total of 52.9 billion tons of raw coal, 5.5 billion tons of crude oil, 5.8 billion tons of iron ore, and 2 billion cubic meters of timber, making historic contributions to establishing China's independent and complete industrial system and promoting national economic development. The biggest advantage of resource-based cities lies in their resources, and the biggest disadvantage also lies in their resources. In the process of development, resource-based cities have accumulated many contradictions and problems, such as a single industrial structure, ecological environment damage, resource depletion, and economic stagnation. In September 2020, China clearly proposed the goals of peaking carbon emissions by 2030 and achieving carbon neutrality by 2060, fully promoting the green and low-carbon transformation of the economy and society. With the determination of the national "dual carbon" goals, resource-based cities at relatively high carbon development levels and high carbon development levels are facing dual pressures of economic transformation and green and low-carbon development. From an economic perspective, environmental regulation is seen as an intervention in market mechanisms aimed at correcting market failures caused by environmental externalities and promoting economic development towards a more sustainable direction. Due to the unique characteristics of China's national conditions and the development process of resource-based cities, the path of green development for resource-based cities in China is even more arduous. The sustainable development of resource-based cities has always been a focus of

attention for local governments and academia. Therefore, studying the impact of environmental regulations on the growth of green economy in resource-based cities has important practical significance, in order to explore more reasonable regulatory measures for the transformation and development of resource-based cities.

2. LITERATURE REVIEW

The current research literature on the relationship between environmental regulations and green economic growth has found three mainstream views. One is the "follow cost theory", which believes that environmental regulations are not conducive to green economic growth; The second is the "innovation compensation theory", which believes that environmental regulations will promote green economic growth; The third is the uncertainty theory, which holds that the impact of environmental regulations on green economic growth is uncertain. 1. Follow the cost theory. This viewpoint holds that when the government implements environmental regulatory policies, enterprises will inevitably increase the cost of pollution control or environmental compliance, reduce their production efficiency, and be detrimental to green economic growth (Gray, 1987). Lanoie et al. (2008) conducted a research and analysis on the manufacturing industry in Quebec, Canada, and found that environmental regulations have a negative impact on green total factor productivity. Lei Ming and Yu Xiaowen (2013) conducted a study and analysis of provincial-level panel data from 1998 to 2011, and concluded that environmental regulations, represented by the completion of industrial pollution control investment and the collection of pollution fees, are negatively correlated with the growth of low-carbon economy total factor productivity. Yuan Yijun and Liu Liu (2013) found that cost based environmental regulations hinder economic growth. Rexhaeuser and Rammer (2014) argue that due to the increase in production costs, environmental regulations cannot promote the improvement of green total factor productivity. 2. Innovation compensation theory. In studies that contradict previous views, some scholars emphasize observing the effects of environmental regulations on economic growth from a dynamic perspective. They believe that although environmental regulations may initially squeeze conventional investment due to increased production costs, in the long run, appropriate environmental policies can incentivize enterprises to engage in technological innovation and bring compensatory effects of innovation (Zhang, et al., 2021). Telle and Larsson explored the relationship between environmental regulations and the green total factor productivity of Norwegian industry in their 2007 study, and found a significant positive relationship between the two. Their analysis was based on panel data, further validating this finding. In 2015, Lambertini et al. studied the promoting effect of environmental regulations on green growth of enterprises. When industry competition is incomplete and consumers have insufficient awareness and understanding of environmental protection, green development of enterprises can be achieved through the impact of environmental regulations on market mechanisms. 3. Uncertainty theory. This viewpoint finds that the impact of environmental regulations on economic growth is non-linear. Cai Wugan and Zhou Xiaoliang (2017) found in their study of 30 provinces in China that command based environmental management did not directly affect green total factor productivity, while market-oriented environmental policies showed an inverted U-shaped effect on green total factor productivity. Autonomous agreement environmental governance had a U-shaped impact on green total factor productivity. Wu Peng et al. (2023) found that both command based and market based environmental regulations can have an impact on the green total factor productivity of industrial enterprises, and they both exhibit a U-shaped relationship.

3. QUANTITATIVE ANALYSIS OF THE IMPACT OF ENVIRONMENTAL REGULATIONS ON GREEN ECONOMIC GROWTH

3.1 Model construction

Based on the relationship between environmental regulations and green economic growth, the following econometric model can be established：

$$\mathrm{lngtfp}_{it} = \alpha_0 + \alpha_1 \mathrm{lner}_{it} + \beta \mathrm{h} X_{it} + \mu_i + \varepsilon_{it} \qquad (1)$$

Among them, $gftp_{it}$ green total factor productivity, er_{it} is environmental regulation intensity, X_{it} is control variable, μ_i is fixed effect, and ϵ_{it} is residual term. I represents city t represents year. α_0 representing constant terms, α_1 and βare the parameters to be estimated.

The relationship between environmental regulations and green economic growth may have endogeneity issues, and the reasons for endogeneity problems are as follows: endogeneity problems caused by missing variables. In the process of analyzing the impact of environmental regulations on the growth of green economy in resource-based areas, although many factors such as economic development level, opening up level, government intervention level, etc. will be considered, there are always some factors that are difficult to quantify or observe, such as the distribution of natural resources. The omission of these factors may have an impact on the research results, leading to endogeneity problems;

The second is the endogeneity problem brought about by bidirectional causality. Specifically, the restrictions on corporate pollutant emissions imposed by environmental regulations not only directly affect the optimal allocation of resources, but also promote the growth of green economy; On the contrary, the level of development of green economy may also in turn affect the strictness of environmental regulations. For example, when a country or region has a high level of green economic growth, policy makers may increase their efforts in environmental protection, thereby increasing the intensity of environmental regulations. Traditional panel data analysis methods are difficult to solve endogeneity problems and cannot guarantee unbiased consistency of data analysis results. However, first-order differential GMM or system GMM can effectively solve endogeneity problems between variables. The first-order differential GMM estimation method is a systematic GMM method proposed by Blundell and Bond in 1998, which uses the horizontal lag value of the variable as the instrumental variable of its first-order differential component to solve the problem of weak instrumental variables. Alvarez and Arellano (2003) found that under limited samples, the results of systematic GMM estimation are more effective than those of first-order differential GMM. Therefore, this chapter mainly adopts the System Generalized Moment Estimation (SYS-GMM) method to calculate the data. Building a dynamic panel model based on formula (1), the specific model is as follows:

$$\text{lngtfp}_{i} = \alpha_0 + \alpha_1 \text{lngtfp}_{i-1} + \alpha_2 \text{lner}_i + \beta \text{h} X_i + \mu_i + \varepsilon_i \quad (2)$$

3.2 Variable Selection

The dependent variable of this article is Green Total Factor Productivity (GTFP), and the core explanatory variable is Environmental Regulation (ER).

The dependent variable.

The dependent variable of this article is Green Total Factor Productivity (GTFP). Drawing on the methods of Chung et al. and Li Weibing, this article adopts the global SBM direction distance function and constructs the Malmquist Lu. enberger Index (ML Index) to calculate the level of green total factor productivity in 281 prefecture level cities. The larger the value, the higher the level of green economic growth; On the contrary, the smaller the value, the lower the level of green overall economic growth.

Core explanatory variables.

The core explanatory variable of this article is environmental regulation (ER), which selects four indicators: wastewater discharge, sulfur dioxide discharge, smoke (powder) dust discharge, and comprehensive utilization rate of solid waste. The entropy method is used to measure the intensity of environmental regulation.

Control variables.

Considering that the economic growth of resource-based cities may also be influenced by their own conditions, efforts should be made to avoid endogeneity issues caused by omitted variables in the future. Based on the availability of data from prefecture level cities, the following six control variables were selected by referring to the methods of Zhang Cheng et al. (2011), Li Bin et al. (2013), Jiang Fuxin et al. (2011), Yuan Yijun (2015), Fu Jingyan (2018), and others:

- Economic development level (LED).
- Population density (PD). Scholars believe that promoting regional innovation requires moderate population density. Wang Yongjin and Zhang Guofeng (2015) found that population aggregation can enhance the externalities of communication and enhance the independent innovation of enterprises. Innovation is an important driving force for regional green economic growth. Therefore, this article chooses population density as one of the control variables. This article uses the population per square kilometer to represent the population density of a region, which is the total population divided by the total area of the region.
- The degree of openness to the outside world (open).
- Government intervention level (GI). Zhang Jianhua and Li Xianzhi (2017) believe that the greater the degree of government intervention, the easier it is for local governments to adopt tough administrative measures when carrying out environmental regulations. Although environmental protection goals can be quickly achieved, it can lead to production interruptions, supply chain disruptions, and other problems, resulting in distorted resource product prices and resource mismatches, hindering the improvement of green total factor productivity. Therefore, this article chooses the degree of government intervention as an important control variable. In terms of measuring the degree of government intervention, common indicators mainly include: marketization index (Fan Gang et al., 2011), labor mobility regulation (Zhao Yong and Wei Houkai, 2015), proportion of state-owned enterprise assets (Yuan Yijun and Xie Ronghui, 201), proportion of government expenditure scale (Pan Hongbo et al., 2008), proportion of urban private and individual employees to employed personnel (etc.). Considering that economic policies have a more direct and significant impact on state-owned enterprises, the larger the proportion of Chinese state-owned enterprises in a certain industry, the stronger the government's policy intervention, and vice versa, the weaker it is. Moreover, it is difficult to obtain other measurement indicators for prefecture level cities. Therefore, this article chooses to focus on the fact that economic policies have a more direct and significant impact on state-owned enterprises. Therefore, the larger the proportion of Chinese state-owned enterprises in a certain industry, the stronger the government's policy intervention, and vice versa, the weaker it is. The larger

the value, the more active the private economy is, indicating that government policies are more effective and direct in intervening in state-owned enterprises. Conversely, the smaller the value, the less effective the intervention in state-owned enterprises is.

• Financial Development Level (LFD). Generally speaking, the level of regional financial development measures the efficiency of regional capital allocation and the degree of borrowing and financing restrictions, representing the degree of regional capital availability. Therefore, most studies use the ratio of financial assets to Gross Domestic Product (GDP) to measure the level of financial development. Drawing on the research of Wang Yongqing et al. (2019), the ratio of total deposits and loans of regional financial institutions to GDP is used as an indicator of regional financial development level. The larger the ratio, the higher the level of financial development.

• Urbanization level (Urban) proportion of urban population in each region to the total population as a proxy variable for urbanization rate.

The descriptive statistics of variables are shown in Table 1.

Table 1
Descriptive statistics of variable

Variable	Mean	Std. Dev.	Min	Max
TFP	1.002	.047	.488	1.655
ER	.98	.053	0	1
PD	5.737	.931	.683	7.882
LED	10.517	.681	4.595	13.056
LFD	2.295	1.161	.56	21.302
Open	.018	.019	0	.199
GI	.186	.098	.043	1.485
Urban	.526	.161	.115	1

3.3 Data sources

The sample study period of this article is from 2006 to 2020. Considering the availability of data, the final research sample includes 281 prefecture level cities in China. According to the Sustainable Development Plan for Resource based Cities (2013-2020), 281 cities are divided into 113 resource-based cities and 168 non-resource-based cities. The research data in this article mainly comes from the China Urban Statistical Yearbook, statistical yearbooks of various provinces and cities, and environmental statistical yearbooks. For the missing data during the sample study period, interpolation method was used to fill it in, and the partial missing data from the last period in 2020 was obtained through trend extrapolation. All data containing price factors in the study were adjusted using the corresponding price index based on 2006, excluding the influence of price factors.

3.4 Empirical Results Analysis

Before conducting panel regression, this article tested the multicollinearity and unit root of the data. The test found that the variance inflation factor (VIF) values of each variable were all less than 10, indicating the absence of serious multicollinearity issues. In order to avoid false regression caused by the presence of unit roots in the data, this study further conducted unit root tests on the data using LLC and IPS methods. The test results rejected the null hypothesis that all variables have unit roots at a statistical level of 5%, indicating that the variable sequence is stationary.

The independent variables and their lagged periods in this article are both used as explanatory variables, which can cause endogeneity issues and lead to model estimation bias. To address this issue, this article adopts a system GMM model for regression estimation. Table 2 reports the total effect estimation results at the national level, resource-based cities, and non-resource-based cities. The Sargan test values reject the hypothesis of over identification of instrumental variables, indicating that there is no problem of over identification of instrumental variables; The AR (2) test indicates that there is no second-order autocorrelation, indicating that the model estimation results are effective and consistent. The regression results of column (1) in Table 2 indicate that the regression coefficient of environmental regulation on total factor productivity is 0.083, which is significant at the 5% statistical level. This means that for every 1% increase in environmental regulation intensity, TFP correspondingly increases by 0.083%. This result is consistent with the previous prediction that environmental regulations have a promoting effect on total factor productivity. Meanwhile, the coefficient of TFP lagging for one period is significantly negative, indicating that TFP has a negative catch-up effect, which is consistent with the research conclusion of Jie Chalk (2008). Table 2, columns (2) and (3) respectively show the estimated results of Environmental Regulation on Production Efficiency Improvement Index (EFFCH) and Technology Progress Index (TECH). The estimated coefficient of Environmental Regulation on Production Efficiency Improvement Index is 0.071, which is significant at the 5% level, indicating that for every 1% increase in Environmental Regulation intensity, production efficiency improvement is 0.071%, and for every 0.026% increase in Environmental Regulation intensity, production technology progress is 0.026%. Environmental regulations have a significant impact on the production efficiency improvement and technological progress of TFP, but in terms of impact, the impact of environmental regulations on technological progress is greater than that on efficiency improvement.

This article further analyzes the impact of environmental regulations on the total factor productivity of resource-based and non resource-based cities.

Table 2
Regression result analysis

Variables	All			Resource Based	Non resource Based
	TFP	EFFCH	TECHCH	TECHCH	TECHCH
Y (-1)	-0.115**	-0.225***	-0.273***	-0.294***	-0.126**
	(-2.26)	(-6.58)	(-7.83)	(-3.64)	(-2.01)
ER	0.083**	0.071**	0.026**	0.198**	0.052**
	(2.31)	(2.20)	(2.20)	(2.45)	(2.02)
PD	0.002	-0.002	0.002	0.010	0.001
	(1.01)	(-0.86)	(0.89)	(1.42)	(0.32)
LED	0.014***	0.008***	0.007***	0.004	0.016***
	(4.65)	(3.00)	(3.19)	(0.63)	(3.50)
LFD	0.003**	0.000	0.001	-0.005**	-0.001
	(2.25)	(0.47)	(1.29)	(-2.01)	(-0.43)
Open	-0.156***	-0.132*	-0.024	-0.228*	-0.138
	(-3.19)	(-1.92)	(-0.51)	(-1.82)	(-1.50)
GI	0.032***	0.019*	0.018	0.089**	0.056*
	(2.68)	(1.69)	(1.58)	(2.58)	(1.91)
Urban	0.011	0.003	0.037***	0.121***	0.021
	(0.77)	(0.19)	(2.66)	(4.32)	(0.69)
Constant	0.858***	1.076***	1.134***	0.937***	0.881***
	(17.93)	(22.05)	(27.03)	(8.24)	(10.74)
Observations	3,617	3,617	3,617	722	1,434
Number of id	279	279	279	221	264
AR(1)	0.000	0.000	0.000	0.000	0.000
AR(2)	0.532	0.155	0.123	0.136	0.639
Sagan test	0.341	0.206	0.176	0.193	0.348

4. CONCLUSION

Based on the calculation of environmental regulations and green economic growth in resource-based cities, this article empirically tests the impact of environmental regulations on green economic growth. This article selected 281 prefecture level cities in China from 2006 to 2020 as research samples and divided them into two groups: resource-based and non resource-based cities. Using panel data from these cities, the relationship between environmental regulation and green economic growth was empirically tested. The main conclusions are as follows: Firstly, for both resource-based and non resource-based cities, environmental regulations significantly promote green economic growth; Secondly, the promoting effect of environmental regulations on green economic growth is more significant in resource-based cities. In summary, environmental regulations have a strong impact on regional green economic growth, and can be used as a driving force to promote green economic growth in resource-based cities.

REFERENCES

Cai, W. J., & Zhou, X. L. (2017). The dual effects of China's environmental regulations on green total factor productivity. *Economist*, (9), 27-35.

Gray, W. B. (1987). The cost of regulation: OSHA, EPA and the productivity slowdown. *American Economic Review, 77*(77), 99-1006.

Lanoie, P., Patry, M., & Lajeunesse, R. (2008). Environmental regulation and productivity: Testing the Porter hypothesis. *Journal of Productivity Analysis, 30*(2), 121-128.

Lei, M., & Yu, X. W. (2013). Local fiscal expenditures, environmental regulations, and China's low-carbon economic transformation. *Economic Science,* (5), 47-61.

Li, H., & Zou, Q. (2018). Research on environmental regulation, resource endowment, and urban industrial transformation: A comparative analysis based on resource-based cities and non-resource-based cities. *Economic Research,* (11), 182-198.

Qin, B. T., Yu, R. Y., & Ge, L. M. (2021). The impact of environmental regulations on the transformation of industrial structure in resource-based cities. *China Environmental Science, 41*(7), 3427-3440.

Telle, K., & Larsson, J. (2007). Do environmental regulations hamper productivity growth? How accounting for improvements of plants' environmental performance can change the conclusion. *Ecological Economics, 61*(2), 438-445.

Yuan, Y. J., & Liu, L. (2013). China needs to be both "green" and "efficient". *Economic Research Reference*, (24), 36.

Zhang, J. (2017). The economic growth effect and transmission mechanism of environmental regulations in resource-based cities: A dual perspective of innovation compensation and industrial structure upgrading. *China's Population, Resources and Environment, 10,* 39-46.