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Fiscal Decentralization, Local Output Pressure and Environmental Pollution

-- Evidence from Zhejiang Province

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Abstract

Ecological civilization is increasingly valued by the party and the people. This paper explores the relationship between fiscal decentralization, local output pressure, and environmental pollution based on panel data from 46 counties in Zhejiang Province from 2007 to 2016. The results show that there is no significant relationship between environmental pollution and fiscal decentralization. The environmental protection expenditures of local governments will alleviate pollution, while the pressure of local output will cause the proportion of local governments' environmental protection expenditures to decrease. Counties with relatively low economic development levels in the same city tend to drive GDP growth by reducing environmental protection expenditures which weakening the government's environmental protection function. Therefore, the performance evaluation to government should attach more importance to environmental quality.

Keywords

Fiscal Decentralization, Local output Pressure, Environmental Pollution.

1. INTRODUCTION

1.1. Environmental Pollution and Economic Growth

In the 40 years since the reform and opening up, China's economy has taken off, and GDP has been growing at a rate of more than 8% per year, and this good momentum has remained so far. However, China's economic growth has brought many social problems. Various problems have arisen from the long-term extensive economic development mode and the industrial structure with resources and labor-intensive industries as the mainstay. The shortage of resources and environmental pollution are becoming increasingly serious. It is urgent to solve environmental problems. Therefore, we must establish the concept of ecological civilization that respects nature, conforms to nature, and protects nature, and takes the path of sustainable development.

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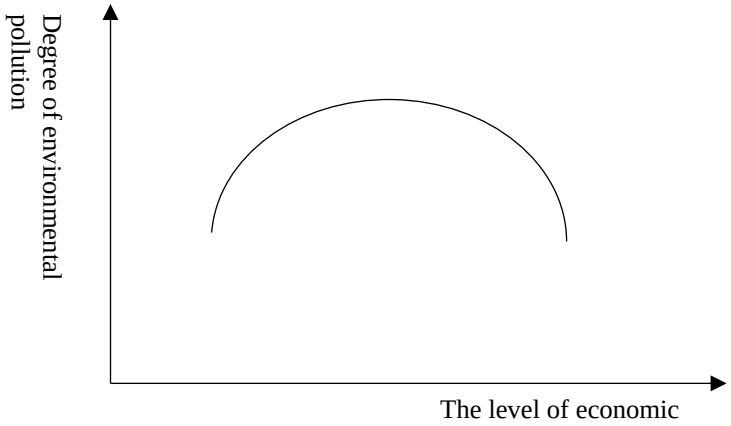

Figure 1. Environmental Kuznets curve

According to the well-known "inverted U-shaped curve" relationship between the degree of income inequality and the level of economic development discovered by Kuzne, Grossman and Krueger were the first to find that an inverted U-shaped curve relationship exists between the level of economic development and the degree of environmental pollution, Called the "Environmental Kuznets Curve (EKC)." It assumes that without certain environmental policy interventions, the environmental quality of a country will deteriorate with the increase of national income during the economic take-off phase; when the country's economy develops to a higher level, economic growth will create conditions for the improvement of environmental quality, It will gradually improve as national income increases [1]. This relationship is shown in Figure 1 below.

On the basis of EKC, Li Meng proposed a "new hypothesis" called the improved EKC [2]. This Chinese-styled EKC points out that with the growth of local fiscal capacity per capita, level of environmental pollution first goes through a rising stage, and then decline after reaching the inflection point of fiscal capacity. This link between economic growth and environmental pollution does not mean that the environmental conditions of developing countries will necessarily improve to a certain stage of economic growth. When resources are severely depleted or degraded, causing environmental degradation to exceed ecological thresholds, environmental degradation is irreversible.

1.2. Environmental Pollution and Fiscal Decentralization

Environmental problems have strong negative externalities which is difficult to be settled by market mechanisms like free competition and maximizing benefits. Therefore, government macro-control must be involved. Using the panel data of 272 prefecture-level cities and above in China from 2003 to 2013, Liu Jianmin, Chen Xia, and Wu Jinguang constructed the comprehensive environmental pollution index to measure the local environmental pollution situation, and analyzed fiscal decentralization from two aspects: heterogeneity and dynamic effects. The relationship between local government competition and environmental pollution leads to the conclusion that environmental pollution has time inertia and positive space spillover characteristics [3]. Liu Jie and Li Wen's empirical examination showed that environmental pollution has a tight spatial linkage in geographical space; the reduction of tax burden has indeed promoted the increase of environmental pollution emissions such as industrial wastewater, industrial waste gas and industrial waste; and the implementation of loose environmental policies by local governments has promoted the increase of industrial wastewater emissions. Local governments tend to undertake lower levels of waste water reduction efforts, and there has been “waste competition” in environmental policies[4].

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Since the reform of the tax-sharing system in 1994, the fiscal decentralization process of the Chinese government has continued to advance. Local governments have gotten more tax and expenditure powers as well as financial pressure. Zhang Xiaoxiao and Dai Yongan have proved that fiscal decentralization promotes local economic growth[5]. In this context, domestic literature on the relationship between government and environmental protection has begun to focus on fiscal decentralization. Wang Huachun and Yu Da analyzed the panel data of 278 prefecture-level cities from 2006 to 2015 and found that the increase in the financial gap of local governments will increase the emissions of industrial sulfur dioxide and industrial dust; most prefecture-level cities in China have already surpassed Kuznets The inflection point of the curve [6]. Liu Jianmin, Chen Xia, and Wu Jinguang proved that the competition between fiscal decentralization and local governments has a significant "poor" effect on environmental pollution. Mao Hui and others declared that increased fiscal decentralization has increased pollution emissions [7]. Li Zhengsheng, Li Ruilin, Wang Hui found that China's fiscal decentralization significantly crowded out local government environmental expenditures [8]. Based on the provincial panel data from 1992 to 2006, Yu Wenchao's research proved the positive relation between the performance of economic growth and the number of environmental pollution accidents; [9] Zhang Xinyi, He Qianyu, Zhao Jun, and Tu Junru have also confirmed the "bad" effect through empirical research [10], [11], [12], [13].

1.3. Environmental Pollution and Performance Competition

According to foreign research results, a decentralized environmental system may lead to very different consequences. When chasing liquid capital, local governments formulate loose environmental policies to attract capital [14]; When pursuing environmental performance, local governments formulate tight environmental policies to expel highly polluting enterprises [15]. The central government avoids decentralization for concerns about the "deterioration" effect which, however, was not suppoted by empirical studies. Fredriksson and Millimet [16] found evidence of strategic environmental policies in the United States, but they were unable to determine whether they had a "bad" or "better" effect. Daniel Millimet's research found that in the 1980s, when fiscal conditions generally improved, the environmental policies of the state governments of the United States even "better"[17]. China's social development stage and political system are different from those of Western developed countries. The effects and mechanisms of fiscal decentralization must be tailored to local conditions. What is the incentive for China's local governments to pursue GDP? One is the prospect of fiscal revenue proposed by Qian Yingyi and Weingast [18]. Another one, which is the focus of this article, is the promotion mechanism of Chinese officials.

Different from the elections in western countries, the appointment of local officials in China comes from the appointment of superiors, and the method of appointment is "promotion competition". The selection criteria of such "bidding competition" are mainly economic growth indicators such as GDP [19].The promotion competition produces a series of distorting consequences, which makes the transformation of Chinese government functions and economic growth mode difficult. Firstly, local officials have no motive to meet the environmental demands of residents. Secondly, the public service does not match the short-term interests of officials. Finally, the promotion competition makes local officials reluctant to change the extensive economic growth mode. Using foreign direct investment per capita in the region as a proxy for intergovernmental competition, Zhao Jun has confirmed that the entry of high-polluting industries and the reduction of regional environmental protection regulations brought about by government competition will hurt local environmental. Yu Wenchao also found that poor performance of economic growth magnified the demands for growth which consequently increased the number of environmental pollution accidents.

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This paper examines the relationship between local government's GDP pressure and government environmental expenditure to verify whether promotion incentives can distort government functions and cause environmental degradation. The second part below describes the data and empirical models used in this article, the third part shows and analyzes the empirical results, and the fourth part is the conclusion of this article.

2. METHODOLOGY

2.1. Indicators Construction

There are two main explanatory variables in this article: environmental pollution index (EP) and environmental protection expenditure ratio (PEE).

In view of the availability and continuity of statistical data, most domestic literature uses the "three wastes" to construct EP. Pan Xiaozhen used wastewater pollution with the highest proportion among pollution sources as a proxy variable for environmental pollution [20]. However, this article believes that at the county level, it is difficult for a single type of industrial waste to fully reflect the degree of environmental pollution in a region. Therefore, this paper uses the three basic indicators of per capita industrial exhaust emissions, per capita industrial wastewater emissions, and per capita industrial solid waste emissions to construct the degree of environmental pollution in each county by the entropy method. The construction of EP is as follows:

Firstly, standardize the individual indicators and eliminate the differences in the magnitude and dimensions of the individual indicators.

$$UE_{ij}^{s} = \frac{UE_{ij} - min\, UE_j}{max\, UE_j - min\, UE_j} + 1 \tag{1}$$

UE_{ij} is the original value of a single indicator, that is, the per capita emissions of the j pollutant in the i province (i = 1,2, ..., n; j = 1,2,3); $max\, UE_j$ and $min\, UE_j$ are the j The maximum and minimum per capita emissions of these pollutants in all provinces; UE_{ij}^{s} is the value standardized by UE_{ij}.

Calculate the proportion of per capita emissions of the j pollutant in the i province.

$$p_{ij} = \frac{UE_{ij}^{s}}{\sum_{i=1}^{n} UE_{ij}^{s}} (0 \le p_{ij} \le 1) \tag{2}$$

Secondly, calculate the information entropy e_j and information utility value d_j of the j pollutant.

$$e_j = -\frac{1}{ln\, n} \sum_{i=1}^{n} p_{ij}\, ln\, p_{ij} \tag{3}$$

$$d_j = 1 - e_j \tag{4}$$

Thirdly, determine the weight ω_j of each individual indicator:

$$\omega_j = \frac{d_j}{\sum_{j=1}^{3} d_j} \tag{5}$$

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Finally, calculate the environmental pollution degree EP_i of the i county through the standardized values and weights of individual indicators

$$EP_i = \sum_{j=1}^{3} \omega_j UE_{ij}^s \times 100 \tag{6}$$

The construction of PEE is the ratio of environmental protection expenditure of local government to total expenditure of local government.

There are three explanatory variables in this article: fiscal decentralization (FD), environmental protection expenditure (PEE), and per capita GDP gap (PGDPG).

This paper uses the per capita fiscal expenditure of the central, provincial and county governments to construct FD. The construction of FD is:

$$FD = fdco/(fdco + fdp + fdf) \tag{7}$$

Where $fdco$, fdp, and fdf donate the per capita fiscal expenditure at the county, provincial, and central levels, respectively.

PGDPG is the GDP gap between a county and the county with the highest GDP among the prefecture-level cities the county belongs to. The construction of FD is:

$$PGDPG_{ijt} = (max\, PGDP_{jt} - PGDP_{ijt})/PGDP_{ijt} \tag{8}$$

Where $PGDPG_{ijt}$ represents the per capita GDP gap of county i in city j in year t, $max\, PGDP_{jt}$ represents the GDP per capita of the county with the largest GDP per capita in city j in year t, and $PGDP_{ijt}$ represents the per capita GDP of county i in j in year t.

The control variables includes each county 's logarithm of GDP per capita (lnPGDP) and its square and lag terms (llnPGDP), industrial structure measured by the county 's secondary industry added value as a percentage of GDP (PS), population logarithm (lnPOP), population density logarithm (lnDPOP) and the proportion of urban population to total population (PU).

2.2. Data

This article uses data from 46 counties in 9 prefecture-level cities in Zhejiang Province from 2007 to 2016. The central fiscal expenditure data comes from the official website of the National Bureau of Statistics, the provincial fiscal expenditure

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
EP	266	121.00	22.64	100.00	184.32
PEE	450	0.03	0.02	0.00	0.19
FD	282	0.18	0.07	0.02	0.39
PGDPG	451	0.70	0.76	0.00	2.84
Ln(PGDP)	466	1.48	0.55	0.05	2.95
Ln(POP)	466	3.88	0.48	2.41	4.80
Ln(DPOP)	466	5.84	0.70	4.34	7.28
PS	466	0.53	0.07	0.13	0.66
PU	466	0.26	0.13	0.10	0.77

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Data comes from the Zhejiang Provincial Statistics Information Network, and the rest of the data comes from the statistical yearbooks of each city. In addition, due to the lack of data, the environmental pollution indicators do not include Hangzhou, Jiaxing, and Taizhou, and Lishui lacks data on the "three wastes" and environmental protection expenditures in 2007 and 2009. Jiaxing and Luzhou lack all data for 2016. Wenzhou city was excluded due to missing data. Zhoushan was excluded because of the archipelago. Yiwu county-level city was excluded due to its special commercial status, and Jingning Dong Autonomous County was excluded as a minority autonomous county. Table 1 gives descriptive statistics of related variables.

2.3. Empirical Model

The model to test the relation between environmental pollution and fiscal decentralization is represent as follow:

$$EP_{ijt} = \alpha + \beta FD_{ijt} + \phi \mathbf{district}_{ijt} + \varphi trend_t + \omega_i + \varepsilon_{ijt} \tag{9}$$

Where EP_{ijt} indicates the environmental pollution index of city i and county in year t; FD_{ijt} represents the fiscal decentralization degree of city i and county in year t; the **district** vector contains the regional control variables of county i in year t: the logarithm of per capita GDP (lnpgdp) of county i in year t and its square term (lnpgdpsq); the ratio of the added value of the secondary industry to the GDP in j city i county in year t (ps); the logarithm of the total population in j city i county in t year (lnpop) and the logarithm of population density (lndpop); the proportion of urban population in total population (pu) in city i county in year t; $trend_t$ represents the time trend of environmental pollution; ω_i represents the individual fixed effect.

The model to test the relation between environmental pollution and environmental expenditure is represent as follow:

$$EP_{ijt} = \alpha + \beta PEE_{ijt} + \phi \mathbf{district}_{ijt} + \varphi trend_t + \omega_j + \varepsilon_{ijt} \tag{10}$$

Where PEE_{ijt} donates the proportion of government environmental protection expenditure in city j and county i in year t, ω_j donates the prefecture fixed effect.

The model to test the relation between per capita GDP gap and environmental expenditure is represent as follow:

$$PEE_{ijt} = \alpha + \beta LPGDPG_{ijt} + \phi \mathbf{district}_{ijt} + \varphi trend_t + \omega_j + \varepsilon_{ijt} \tag{11}$$

Where $LPGDPG_{ijt}$ represents the first-order lag value of the per capita GDP gap in city i and county j in year t; the square term of the logarithm of per capita GDP (lnpgdpsq) of county i in year t is excluded from the **district** vector and the first-order lag value of the logarithm of per capita GDP (llnpgdp) of county i in year t is added into the **district** vector.

3. EMPIRICAL RESULTS

3.1. Environmental Pollution and Fiscal Decentralization

Table 2 presents the OLS estimation results of Equation (9). In column (1), the results from mixed regression are shown. The coefficient of FD is negative in the mixed regression, which is inconsistent with the previous expectations, and the statistical significance level is extremely

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low; In column (2), the results from individual fixed-effect regression are shown.; after considering the individual fixed

Table 2. Results of estimations of Equation (9)

	(1)	(2)
FD	2.701	9.300
	(22.510)	(11.177)
Ln(PGDP)	-19.859	-22.195***
	(16.309)	(8.345)
Square of Ln(PGDP)	8.445*	1.828
	(4.733)	(1.681)
Ln(POP)	0.207	-175.265***
	(3.708)	(37.764)
Ln(DPOP)	7.332	274.986***
	(4.942)	(54.094)
PU	24.036	-15.334***
	(19.600)	(5.516)
PS	-52.845**	27.196
	(25.453)	(19.117)
Trend	-1.662**	1.552*
	(0.716)	(0.843)
N	266	266
r2_a	0.0894	0.9513

Note: Robust standard errors are reported in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Effects, the coefficient of FD becomes positive, consistent with the previous expectations, but the significance level is still not significant at a significance level of 10%. This results show that fiscal decentralization has no significant impact on environmental pollution in the case; for each control variable in the fixed effect regression, the coefficient of the total population is significantly negative, the coefficient of the population density is significantly negative, and the time trend loses its significance after adding individual effects.

Column (1) of table 3 shows the estimation results of Equation (10). The estimated coefficient of the PEE is -107.559 and statistically significant at a significance level of 5%, indicating that an increase of 1 unit in the proportion of environmental protection expenditure by local governments will reduce the environmental pollution index by 107.559 which means local government environmental protection expenditures will indeed alleviate environmental pollution.

Column (2) and (3) of table 3 shows the estimation results of Equation (11). In column (2), the results from mixed regression are shown. The estimated coefficients of LPGDPG in the mixed regression is -0.008 and statistically significant at 1%. In column (3), the results from city fixed effect regression are shown. After considering the individual fixed effects, the estimated coefficients of LPGDPG is -0.019 and still statistically significant at 1%, and its magnitude even grows, which means the

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Table 3. Results of estimations of Equation (10) and (11)

	(1)	(2)	(3)
PEE	-107.559**		
	(49.672)		
LPGDPG		-0.008***	-0.019***
		(0.002)	(0.004)
Ln(PGDP)	-33.441*	0.018	-0.003
	(17.170)	(0.021)	(0.016)
Square of Ln(PGDP)	13.041***		
	(4.891)		
Lag of Ln(PGDP)		-0.024	-0.032**
		(0.021)	(0.016)
Ln(POP)	2.803	0.004	0.001
	(3.292)	(0.004)	(0.005)
Ln(DPOP)	4.268	-0.011***	-0.005
	(5.688)	(0.002)	(0.005)
PU	24.353	0.060***	0.026***
	(20.810)	(0.011)	(0.010)
PS	-42.524	-0.047*	-0.051*
	(30.118)	(0.027)	(0.028)
Trend	-1.797*	-0.002***	0.001
	(1.003)	(0.001)	(0.001)
N	266	403	403
r2_a	0.1380	0.1682	0.3589

Note: Robust standard errors are reported in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Unobservable, time-invariant variables at prefecture level result in underestimation of the coefficient of LPGDPG. The results confirm the previous speculation: counties with more poor economic performance tend to reduce environmental protection expenditures. According to fixed effect regression, for each unit of LPGDPG, the proportion of local government's environmental protection expenditure will decrease by 1.9%.

4. CONCLUSION

Based on panel data of 46 counties in Zhejiang Province from 2007 to 2016, this paper draws the following conclusions: For Zhejiang Province, fiscal decentralization at the county level has no significant impact on environmental quality ; the environmental protection expenditures of local governments will indeed alleviate pollution; and the per capita GDP gap has a significant negative relation with the proportion of local government environmental protection expenditures. It means that the governments of counties with relatively low level of econnomic development are under greater pressure on growth of GDP and tend to stimulate output by reducing environmental protection expenditures which indirectly weaken the government's environmental protection functions.

To reverse such vicious trend and promote the construction of ecological civilization, it is recommended that the central government adjust the assessment standards to officials and attach more importance to environmental protecttion.

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