Study on the Impact of Local Government Tax Competition on Environmental Pollution

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Abstract: In order to develop the regional economy, there is widespread competition among local governments. Tax competition is the main form of competition among local governments. Competition brings rapid development to the regional economy, but also has a certain impact on environmental pollution. The theoretical analysis shows that regional tax reduction can attract more industries and aggravate regional environmental pollution. The empirical analysis shows that there is a significant negative correlation between regional tax level and environmental pollution, which further verifies the relationship between local tax competition and environmental pollution.

1. Introduction

Since the reform and opening up, China's economy has developed rapidly. During the 38 years from 1978 to 2015, the average annual growth rate of China's economy reached 9.7%, creating a world miracle. The export-oriented economic model is the reason for the success of China's economy. However, some scholars have shown that local government competition under centralization is the main reason for the rapid development of China's economy. In order to promote the economic development of the region, there are many kinds of competition modes among local governments, among which tax competition is one of the most popular and effective competition modes. Local governments attract capital inflows through tax preferences, which has always brought labor inflows and economic growth to the region. In order to gain more development advantages, local governments sacrifice the environment at the expense of the environment, thus causing the continuous deterioration of China's environmental quality [1]. Although China has introduced a series of measures in environmental protection, local governments still reduce environmental costs for enterprises through tax incentives and financial returns, with the aim of retaining or attracting more enterprises and enhancing the economic strength of the region. So can competition among local governments really lead to environmental pollution? What is its mechanism? Based on the theoretical analysis, this paper analyzes the impact of local government competition on environmental pollution, and through the spatial self-lag model to analyze the causal relationship between local government competition and environmental pollution, so as to verify whether the local government competition represented by tax competition has caused environmental pollution.

2. Literature review

Research on the impact of local tax competition on environmental pollution has reached a consensus conclusion. In local tax competition, reducing tax rate will aggravate environmental pollution, but will bring about regional economic development. Oates and Schwab constructed two regional models. The study found that inter-regional tax competition can affect the behavior decision-making of enterprises. Enterprises tend to migrate to areas with low tax rates, while areas with high tax rates will also show the willingness to reduce tax rates, so competition among local governments will aggravate environmental pollution [2]. Kim and Wilson pointed out that tax

competition among local governments would reduce the supply of local public goods and lead to "lower competition" of environmental standards, which would aggravate regional environmental pollution. Cremer and Gahvari point out that reducing output tax can increase the output of enterprise products, consumers will consume more pollution-intensive products, if the pollution tax is increased, the final price of products will increase, and the reduction of output will contribute to the reduction of pollution emissions. Cui Yafei, a domestic scholar, has found that the form of local tax competition is more flexible. According to the different tax collection strategies for different pollutants, the control of fixed wastes and wastewater is more stringent, but the control of air pollution appears the phenomenon of "competition by competition". Through the empirical analysis of spatial econometric model, Liu Jie found that local government competition is conducive to the development of regional pollution industry and increase industrial pollution emissions [3]. Li Xiangju used the efficiency of tax collection and management of local governments and the total tax burden of local governments to measure tax competition. Empirical data from 28 provinces from 2007 to 2014 showed that the higher the efficiency of tax collection and management, the lower the degree of environmental pollution, and the higher the overall macro tax burden of local governments, the more serious the environmental pollution.

3. Theoretical analysis

This paper assumes that local governments compete for tax revenue in order to attract more liquidity capital. Using Hayashi's and Boadway's research ideas for reference, this paper assumes that the adjustment of capital flow will produce certain costs. On this basis, the environmental pollution is introduced into the model, and the theoretical model of the relationship between tax competition and environmental pollution is constructed.

Assuming that there are three adjacent areas, which are represented by A, B and C respectively, industrial enterprises need only capital and labor for production. This paper assumes that labor can be completely replaced by capital. Referring to Levinson's research results, the industrial scale is represented by alpha. The value range of alpha is [0,1]. The larger the alpha, the more developed the industrial industry in the region is, the more serious the regional pollution is. On the contrary, the regional environmental pollution emission is less. Interregional capital flow will lead to the change of industrial scale, so this paper regards capital as a function of regional industrial scale, and uses capital flow to represent industrial transfer in the region [4].

Assuming that regions B and C are homogeneous, The production functions of area A and area B are respectively $F_A(K_A(\alpha_A))$ and $F_B(K_B(\alpha_B))$, The production functions in both regions conform to the law of diminishing marginal output of factors, and the first and second derivatives of all production functions meet the requirements: $F_A'(K_A(\alpha_A)) > 0$、$F_B'(K_B(\alpha_B)) > 0$ and $F_A''(K_A(\alpha_A)) < 0$、$F_B''(K_B(\alpha_B)) < 0$，Assuming that there are different production costs in A and B regions, the production costs in A and B regions are a and b respectively, the two regions have certain autonomy in tax rates. Assuming that the tax rates in A and B regions are t_A and t_B respectively, the capital gains in both regions can be expressed as follows:

$$\pi_A = (p - t_A - a)F_A'(K_A(\alpha_A) \qquad (1)$$

$$\pi_B = (p - t_B - b)F_B'(K_B(\alpha_B) \qquad (2)$$

Capital can flow freely in the region on the premise that it needs to pay a certain cost of capital adjustment. Assuming that the cost of capital adjustment is different in different regions, the cost of capital adjustment in region A is c_A, the cost of capital adjustment in region B is c_B, c_{A+B} is the cost of capital adjustment for the whole region. Assuming that the cost of capital adjustment is strictly convex, its first derivative is greater than 0. When the regional capital gains are the same, there is no motive for capital to flow. At this time, the whole regional capital is in a stable state [5].

$$r + c_{A+B} = (p - t_A - a)F_A'(K_A(\alpha_A)) - c_A = (p - t_B - b)F_B'(K_B(\alpha_B)) - c_B \quad (3)$$

r is the rate of return on capital of the whole region. Partial derivatives of t_A are obtained on

both sides of equation (3).

$$[(p - t_A - a)F_A''(K_A(\alpha_A)) - C_A']\frac{\partial \alpha_A}{\partial t_A} - F_A'(K_A(\alpha_A)) = [(p - t_B - b)F_B''(K_B(\alpha_B)) - C_B']\frac{\partial \alpha_B}{\partial t_A} \quad (4)$$

$$[(p - t_B - b)F_B''(K_B(\alpha_B)) - C_B']\frac{\partial \alpha_B}{\partial t_A} = C_{A+B}'(\frac{\partial \alpha_A}{\partial t_A} + \frac{\partial \alpha_B}{\partial t_A}) \quad (5)$$

For convenience of expression, This paper indicates$\beta = [(p - t_A - a)F_A''(K_A(\alpha_A)) - C_A']$, $\gamma = [(p - t_B - b)F_B''(K_B(\alpha_B)) - C_B']$, because $p - t_A - a > 0$, $F_A''(K_A(\alpha_A)) < 0$、$F_B''(K_B(\alpha_B)) < 0$, $C_A' > 0$、$C_B' > 0$,so $\beta < 0$、$\gamma < 0$。Name$\delta = C_{A+B}' > 0$, $\theta = F_A'(K_A(\alpha_A)) > 0$, Equations (4) and (5) can be simplified as follows:

$$\beta \frac{\partial \alpha_A}{\partial t_A} = \gamma \frac{\partial \alpha_B}{\partial t_A} + \theta \quad (6)$$

$$\gamma \frac{\partial \alpha_B}{\partial t_A} = \delta \frac{\partial \alpha_A}{\partial t_A} + \delta \frac{\partial \alpha_B}{\partial t_A} \quad (7)$$

According to equation (7):

$$\frac{\partial \alpha_A}{\partial t_A} = \frac{(\gamma - \delta)}{\delta} \frac{\partial \alpha_B}{\partial t_A} \quad (8)$$

By introducing equation (8) into equation (6), it is obtained that:

$$\frac{\partial \alpha_B}{\partial t_A} = \frac{\theta \delta}{\beta \gamma - \beta \delta - \delta \gamma} > 0 \quad (9)$$

According to equation (8) and equation (9), we can get:

$$\frac{\partial \alpha_A}{\partial t_A} = \frac{(\gamma - \delta)\theta}{\beta \gamma - \beta \delta - \delta \gamma} < 0 \quad (10)$$

Based on the above analysis, the following propositions can be drawn in this paper:

Proposition (1) Under the condition that the tax rate of other regions is unchanged, the tax rate of this region is inversely proportional to the industrial scale of this region, and the increase of tax rate will lead to the reduction of local industries, thus enabling the environmental pollution of this region.

Proposition (2) In the case of tax competition among local governments, the tax rate of neighboring regions is proportional to the industrial scale of the region, so the increase of tax rate in neighboring regions will expand the industrial scale of the region, which will lead to serious environmental pollution.

Assuming that there is a difference between area B and area C adjacent to area A, assuming that the tax rate of area C is t_C and the production cost is c, when the cost of the whole area is the same, there is $a + t_A = b + t_B = c + t_C$. If the tax rate of area A increases at this time, the industry of area A will move to area B or area C with lower tax rate, and the industry transfer will choose between adjacent areas, and finally the industry transfer will take place. The choice of destination depends on the production cost of area B and area C. If $b + t_B > c + t_C$, the industry will eventually transfer to area C. If $b + t_B < c + t_C$, the industry will eventually transfer to area B. Based on the above analysis, the following propositions can be drawn:

Proposition (3): Adjustment of regional tax policy will lead to industrial transfer. The path of industrial transfer depends on the production costs of adjacent areas. Enterprises with high pollution characteristics tend to transfer to areas with low production costs.

4. Empirical Test and Result Analysis

According to the theoretical analysis and research purposes, this paper establishes the following empirical analysis model:

$$P_{it} = \alpha_0 + \alpha_1 Tax_{it} + \alpha_2 Str_{it} + \alpha_3 Pg_{it} + \alpha_4 Ur_{it} + \alpha_5 Reg_{it} + \varepsilon_{it}$$

Among them, P_{it} represents the level of environmental pollution in the region. This paper uses

environmental index to measure the level of environmental pollution. The environmental index is obtained by using the data of "three wastes of industry" through the entropy method. The core explanatory variable is "Tax" it, which refers to the tax rate of environmental pollution in the region. Environmental pollution is mainly caused by industrial enterprises, so this paper uses the proportion of the total industrial tax revenue in the total industrial output value of the region to measure. Quantity, Str_{it} is the regional industrial structure, which is measured by the proportion of the output value of the secondary industry; Pg_{it} is the level of regional economic development, which is measured by the per capita gross domestic product; Ur_{it} is the level of urbanization, which is expressed by the proportion of urban population to the total population; Reg_{it} is the level of regional environmental regulation, which is based on the project of industrial pollution control. The ratio of annual total investment to total industrial output is expressed. This paper uses the panel data of China's provincial level from 2010 to 2016 to make an empirical analysis. Due to the lack of data in Tibet, this paper contains 30 sample provinces. The data needed are from China Statistical Yearbook and China Environmental Statistical Yearbook from 2011 to 2017.

In order to ensure the correctness of regression analysis, this paper uses fixed effect and random effect to carry out regression analysis. Through Hausman test, this paper uses fixed effect model to carry out regression analysis to determine the final regression mode. The basic regression results are shown in Table 1.

Table 1 Basic regression results of the impact of tax competition on environmental pollution.

variable	Model(1)	Model(2)	Model(3)	Model(4)	Model(5)
Tax_{it}	-0.057*** (-2.87)	-0.058*** (-2.13)	-0.061*** (-3.92)	-0.054*** (-2.98)	-0.066*** (-3.09)
Str_{it}		2.873*** (7.94)	3.182*** (5.92)	2.873*** (9.82)	2.652*** (7.82)
Pg_{it}			-0.293** (-3.98)	-0.145*** (-2.19)	-0.129** (-2.99)
Ur_{it}				-0.013*** (-1.97)	-0.017*** (-2.37)
Reg_{it}					-0.237*** (-3.87)
C	1.663*** (2.83)	1.863*** (3.09)	1.773*** (2.19)	1.563*** (2.15)	1.653*** (3.01)
sample size	210	210	210	210	210

Table 1 shows the basic regression results of this paper. Model (1) is the regression result of the relationship between environmental pollution index and regional tax rate. Model (2) - (5) is the regression result after adding each control variable separately. From Table 1, we can see that there is a significant negative correlation between local tax rate and environmental pollution index. The impact of model (1) - (5) tax rate on environmental pollution is significant at the level of 1%. The empirical regression results are consistent with the theoretical analysis in this paper. The proportion of secondary industry is positively correlated with the index of environmental pollution, and the source of environmental pollution is mainly industrial production. Therefore, the larger the proportion of secondary industry, the more pollution emissions and the worse the environmental quality, the regression results of this paper conform to empiricism; the level of economic development is negatively correlated with environmental pollution, and the higher the regional economic level, the more peaceful competition attitude of local governments will not be maintained. The higher the income level is, the more obvious the preference for optimizing environmental quality is. So the level of regional economic development is negatively correlated with environmental pollution. The level of urbanization is similar to the level of regional economic development. The higher the level of regional urbanization, the more open the attitude to regional competition. Therefore, high urbanization can ease regional competition, and further more. Improving regional environmental quality; the level of environmental regulation is negatively

correlated with environmental pollution, and the higher the level of environmental regulation, the less pollution emissions.

5. Conclusion

Firstly, this paper makes a theoretical analysis of the relationship between local competition represented by tax competition and environmental pollution, and then makes an empirical analysis using panel data of 30 provinces in China from 2010 to 2016. The theoretical analysis shows that the tax competition among local governments can aggravate the level of regional environmental pollution, and the promotion of regional tax level will lead to the industrial migration of the region, thereby reducing the level of environmental pollution in the region, and at the same time will lead to the aggravation of environmental pollution in the adjacent regions; the regional tax competition will lead to industrial transfer, while the path of enterprise transfer depends on the level of tax in the adjacent regions. Empirical test results show that there is a significant negative correlation between local tax level and environmental pollution, and the significant level is significant at the level of 1%.

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