Research on the Threshold Effect of Environmental Regulations on Green Technological Innovation

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Abstract: *Environmental regulations are an effective means to restrict the negative externalities of environmental pollution from green technology innovation. A reasonable measurement of its impact on green technology innovation is the key to balancing economic development and environmental protection. The article selects 30 provincial panel data in my country from 2009 to 2017, and uses the panel threshold model to analyze the impact of environmental regulations on green technology innovation. The study found that: environmental regulations can effectively promote the level of green technological innovation; environmental regulations have a significant threshold effect on green technological innovation. As the intensity of environmental regulations increases, its promotion of green technological innovation has a marginal effect; environmental regulations have a diminishing effect on the level of green technological innovation. The optimal intensity interval is below 1.261.*

Keywords: *Environmental Regulation, Green Technological Innovation, Fixed Effects Model, Threshold Regression Model*

1. Introduction

Under the rapid economic development of our country in the past, although we have achieved world-renowned achievements, in order to maximize the benefits, we do not pay attention to protecting the environment. In the long run, it has also brought a series of ecological and environmental problems to our country, which have seriously affected our country. During "14th Five-Year Plan" period, "improving system construction and consolidating the foundation for ecological and environmental protection; promoting green development and promoting green production methods and lifestyles" has been listed as the key direction of ecotope conservation job. The coordinated promotion of ecological surroundings guard and economic progress has become an inevitable requirement for sustainable envolution in new time.

In the face of the "economy-environment" vicious circle formed under the previous development model, green technological innovation is a breakthrough to coordinate economic progress and surroundings guard. Green technological innovation has the characteristics of negative externalities related to environmental pollution. Due to the lack of a market pricing mechanism for pollution emissions, the cost of pollution discharge is often underestimated by enterprises. The cost of pollution discharge by enterprises is lower than the social cost, which leads to excessive emissions. The negative externality of corporate environmental pollution has a restraining effect.

Therefore, the key for the government to achieve the "win-win" of economic development and surroundings guard in finding the optimal intensity range of surroundings regulations. Realizing the optimization of environmental regulations has become the key to growing the efficiency of green science innovmion.

2. Literature Review

Through combing the existing literature, it is found that the impact of surroundings regulations about green technology innovmion is mostly centered on "Porter Hypothesis". From different angles, a variety of methods are used to carry out in-depth research, and the following three viewpoints are mainly formed: (1) surroundings govern promote the development of green technological innovation [1-3]. Environmental regulations motivate enterprises to implement green technological innovation,

produce "innovation compensation effects", and make up for the negative effects of "compliance costs". (2) Surroundings govern inhibit the growth of green technological innovation [4-6]. Surroundings govern increase the expense of pollution control for fiem, produce a squeeze out action on enterprises' R&D put in and reduce corporate profits. Therefore, they cannot stimulate enterprises to implement green technological innovation and do not support the "Porter Hypothesis." (3) The affect of Surroundings govern on green science innovmion is uncertain [7-10]. As the intension of Surroundings govern changes, green science innovmion is increased or descend, "Porter Hypothesis" can only be realized if it reaches a certain intensity range.

The research characteristics of this paper: First, from the research content, based on the "negative externality" characteristics of green science innovmion, explore the affect of environmental regulations on greenscience innovmion. Second, from the technical level, taking the standard of green science innovmion as research object, using the panel threshold model to research the misalignment filiation , then seeking the optimal intensity interval of environmental regulation.

3. Research Design

3.1. Panel Threshold Model

For the sake of better study theinfluence of ciontext management on the level of green science innoviom, the panel threshold data model proposed by Hansen [14] divides the interval endogenously according to the characteristics of the data itself, and Further analysis of the filiation between them. The non-linear relationship. Taking the environmental regulation intensity lnerit, γ is the specific door sill value of the door sil variable, and the single door sil is taken as an example to construct the following model:

$$ln\,GTI_{it} = \beta_1\,ln\,IS_{it} + \beta_2\,ln\,IE_{it} + \beta_3\,Open_{it} + \beta_4\,DN_{it} + \beta_5\,HCL_{it} + \beta_6\,ln\,ER_{it}$$
$$\times I(ln\,er_{it} \leq \gamma) + \beta_7\,ln\,ER_{it} \times I(ln\,er > \gamma) + C + \varepsilon_{it} \tag{1}$$

Among them, i show the area, t show the time, which is the explained variable, lnISit, lnIEi, Openit, DNit, HCLit are other variables that significantly affect the explained variable, that is, the control variable, which is the indicator function, ~iddN(0,δ2). In the formula, lnERit is the explanatory variable affected by lnerit, lnerit represents the intensity.

3.2. Variable Selection

(1) Green Technology Innovation (GTI): The sum of the annual green invention patents and green utility model patent applications in various regions of my country is selected to characterize the level of green technological innovation.

(2) Environmental regulations (ER) and intensity of environmental regulations (er): There are many methods to measure environmental regulations, such as the annual environmental pollution control investment in various regions of our country [11]. In this paper, the found in technical contaminate control projects in various regions this year represents environmental regulation[13], and the eta of the FDI in technical contaminate in various regions this times to prime commerce income of technical firm on designated size represents intensity of environmental regulations [12] .

(3) Green technological innovation may also be affected by other factors. With reference to existing literature, this paper selects industrial scale (IS), innovation environment (IE), degree of openness (Open), degree of nationalization (DN), and human capital level (HCL) as control variables for analysis and research.

3.3. Data Source

This article uses the 2009-2017 data of 30 states (urbans, districts) in the mainland of my country as the research sample. Tibet is excluded from the 31 regions to serious miss information[15]. The information root in WIPO, China Statistical Yearbook, China Environmental Statistics Yearbook and so on.

4. Empirical Analysis

4.1. Model Parameter Estimation and Analysis Results

This paper uses the strength of surroundings regulation as the threshold alteralbe to test the panel threshold effect of each explanatory variable. The results are shown in *Table* 1.

Table 1: Parameter estimation consequence of threshold model

Model one			
Explanatory variables	coefficient	t value	P>t
IS	0.610***	6.45	0.000
IE	0.380***	8.68	0.000
Open	-0.495*	-1.80	0.073
DN	2.278	1.57	0.118
HCL	-0.903***	-3.17	0.002
ER_1	0.580***	6.50	0.000
ER_2	0.446***	6.45	0.000
ER_3	0.432***	6.36	0.000
ER_4	0.326***	6.42	0.000
Constant term	-9.879***	-7.55	0.000
R2	0.7956		
F value	89.52***		

Note: ***, **, *respectively indicate significant at the level of 1%, 5%, and 10%

Surroundings govern exsit a threshold domino on green technology revolutionary. From estimated results, it can be seen that no matter which range of environmental regulation intensity is, environmental regulations will have a active affect on green science revolutionary. Surroundings regulations can promote science innovation. When the intensity of environmental regulation is in the first range, the number of words that the intensity of surroundings management has on green technological innovation is 0.580, and it is distinct at the 1% standard, indicating that surroundings management has a positive impact on green surroundings management; when the strongth of surroundings management is in the first interval In the second interval, the positive function of surroundings management on green science innovation has declined; when the intensity of surroundings management is in the third interval, the promotion of green seience innovation by surroundings management continues to weaken; when the intensity of environmental regulations is in the strongest regulatory interval, The affect of surroundings management on green science innoviom has dropped significantly, and the impact coefficient has dropped to 0.326.

4.2. Research Conclusions and Policy Recommendations

In view of the fact that environmental regulation policies can effectively constrain the "heavy externality" characteristics of green science reformation, this essay use my country's 2009-2017 provincial panel data to conduct empirical research on the nonlinear impress between environmental management and green seience reformation, by successively applying fixed effects The panel threshold model draw the following conclusions: (1) Environmental regulation and green technological innovation can promote its rate. (2) The influence ofsurroundings regulations on green seience innovation depends on the strength of environmental regulations. (3) Only when the environmental regulation is in a reasonable range, that is, the strength of the surroudings command does not exceed 1.267, can we maximize the standard of green science innovation a.

This article offers a consult to come true government environmental regulation policies : (1) Theoretically analyze that surroundings control can promote green technological revolutionary. However, in real life, many firms have been affected by the original production methods and production methods. There is dependence on technology, and they are unwilling to implement green technological innovation. Therefore, it is needfulto supply play to the market-oriented role, increase market demand for green science, and let market demand guide enterprises to innovate. (2) The implementation of surroundings control policies must be based on national conditions, and fully

consider the unlike in the level of economic blossom, resource endowments, etc. of various regions, formulate practical environmental regulation intensity, effectively reduce pollution control costs, and stimulate green science transfrom Power, and effectively improve the level of green technology innovation in my country.

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