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Research on the Spatial Effect of Green Investment on High-quality Economic Development

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Abstract

With the rapid development of economy, China's total economic output ranks the second in the world, but in the face of huge economic output, there are still serious problems in the internal industrial structure. Under the traditional economic development mode, it is not conducive to the optimization of the industrial structure, but also makes it impossible to further improve the efficiency of financial institutions. Therefore, in the context of the supply side reform, it is particularly important to change the economic development mode, adjust the industrial structure, and implement green finance. Through the green project evaluation, we can guide the capital flow to the intensive industries with low investment, low pollution, low energy consumption, and high efficiency. At present, China's economic development is in the transition stage from high speed to high quality [1]. Based on five aspects of innovation, coordination, green, openness and sharing, this paper evaluates the high-quality economic development level of provinces and cities in China from 2011 to 2020, and analyzes the spatial effect of green investment on high-quality economic development.

Keywords

Green Investment; High Quality Economic Development; Spatial Effect.

1. Introduction

With the rapid development of the world economy and the rapid expansion of the economic aggregate, while countries around the world enjoy the dividends brought by economic growth, resource consumption and environmental pollution are gradually threatening the survival of mankind. In order to achieve the dual development of economy and environmental quality, scholars around the world have carried out in-depth and extensive research.

In terms of the relationship between green investment and economic development, Liu Dehai (2017) elaborated the connotation of green development from five perspectives: economic development, political construction, ecological environment, social development and cultural value. Zheng Zihui (2018) took Beijing Tianjin Hebei region as the research object for empirical analysis, pointing out that environmental protection investment can promote industrial ecological development, improve resource utilization and curb environmental pollution. Zhu H. et al. (2019) believed that the essence of green development is to realize the transformation of the economic development model, from extensive development to intensive development, and

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to realize the "three low" and "three high" development model, namely, low consumption, low emissions, low pollution, high efficiency, high efficiency, and high circulation. Therefore, the core of green development is to improve resource and environmental productivity. Amir (2020) found that the investment of polluting enterprises in green technology and green management can be regarded as the development direction of green investment. Kristina (2018) pointed out that green city investment will be the new direction of green investment development. On the impact of green investment on high economic development. The Research Bureau of the People's Bank of China believes that it is of great significance to strengthen the awareness of green environmental protection in the context of modernization. Zhang Minglong (2020), based on the Dubin model test, concluded that green investment in the process of marketization has a significant effect on promoting high-quality economic development.

2. Green Investment

Green investment forms green productivity, which is manifested in the implementation of cleaner production in production, namely, energy saving, material recycling production with no or less waste [2]; In terms of products, they are miniaturized (less waste), multifunctional (more useful), recyclable, and less polluting to the environment; In terms of environmental protection, production and environmental protection are carried out at the same time. The production process is not only an output process, but also a process of pollution prevention and treatment.

3. High Quality Economic Development

High quality economic development is the core concept of development economics. High quality economic development is also called economic development. Real economic development is high-quality economic development. Therefore, in essence, high-quality economic development and economic development are synonymous. High quality economic development is the growth mode of innovation driven economy. High quality economic development has achieved the unity of growth and development, and the unity of growth mode and development mode. High quality economic development is the essential feature of the modern economic system and the fundamental goal of the supply side structural reform [3]. The indicator system for measuring high-quality economic development includes four dimensions, as follows:

(1) Innovative development dimension. It includes three aspects: innovation basis, innovation input and innovation output.

(2) Coordinated development dimension. It includes industrial structure, consumption investment structure and financial structure.

(3) Green development dimension. It includes resource consumption and environmental pollution. (4) Sharing development dimensions. It includes three dimensions: living basis, social security and cultural enjoyment [4].

4. Variable Selection and Model Construction

4.1. Variable Selection

(1) Interpreted variable. High quality economic development level is selected as the explained variable.

(2) Explanatory variables. Take green investment as the explanatory variable.

(3) Control variables. Select some control variables that reflect the characteristics of provinces and cities and have a certain impact on high-quality economic development. Referring to the

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practice of Zhou Di and other scholars, government expenditure, human capital level, per capita water resources, industrialization level, etc. are selected as control variables.

4.2. Model Construction

(1) Construct comparison judgment matrix.

The comparison judgment matrix is constructed as follows:

$$A=\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{31} & a_{32} \end{pmatrix} \tag{1}$$

Where, $a_{ij}=\frac{1}{a_{ji}}$.

(2) Calculate the maximum eigenvalue of the matrix.

Normalize the matrix column to obtain A, and calculate the row sum to obtain B.

$$A=\begin{pmatrix} a_{11}' & a_{12}' & a_{13}' \\ a_{21}' & a_{22}' & a_{23}' \\ a_{31}' & a_{32}' & a_{33}' \end{pmatrix} \tag{2}$$

$$B=\begin{pmatrix} a_{11}'+a_{12}'+a_{13}' \\ a_{21}'+a_{22}'+a_{23}' \\ a_{31}'+a_{32}'+a_{33}' \end{pmatrix} \tag{3}$$

The weight of each indicator obtained by normalization is W.

$$W=\begin{pmatrix} w_1 & w_2 & w_3 \end{pmatrix}^T \tag{4}$$

$$C=AW=\begin{pmatrix} c_1 \\ c_2 \\ c_3 \end{pmatrix} \tag{5}$$

The maximum characteristic value is:

$$\lambda_{\max}=\frac{1}{n}\left(\frac{c_1}{w_1}+\frac{c_2}{w_2}+\frac{c_3}{w_3}\right) \tag{6}$$

Consistency check under single criteria:

$$CI=\frac{\lambda_{\max}-n}{n-1}\ CR=\frac{CI}{RI} \tag{7}$$

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5. Empirical Analysis

First of all, we processed the data and found that the high quality economic development level of each province and city from 2011 to 2020 was, and the original series was obtained. We found the rank of the original series. If almost all the tribes were in between, then the model was applicable to these data to weaken the randomness of the objective phenomenon and better reflect its regularity. We accumulated the original data to obtain a new series.

$$y_1, y_2, y_3 \dots y_{10} y^{(0)} = \left\{ {y_1}^{(0)}, {y_2}^{(0)}, {y_3}^{(0)} \dots {y_{10}}^{(0)} \right\} \tag{8}$$

$$L(t)(e^{-\frac{2}{11}}, e^{\frac{2}{11}})L(t) = \frac{{y_{t-1}}^{(0)}}{{y_t}^{(0)}}, (t = 1,2 \dots 10) \tag{9}$$

$$D(t) = \frac{{y_t}^{(1)} - {y_{t-1}}^{(1)}}{2} {y_t}^{(1)} = \sum_{t=1}^{t} {y_i}^{(0)} \tag{10}$$

We have established whitening equation ${y_t}^{(0)} + \mu {d_t}^{(1)} = \lambda$. According to the definition of derivative $\frac{dy^{(1)}}{dt} = \lim_{\Delta t \to 0} \frac{{y_{t+\Delta t}}^{(1)} - {y_t}^{(1)}}{\Delta t}$, it is introduced into the whitening equation to obtain the following equation:

$${y_{t+1}}^{(1)} - {y_t}^{(1)} = {y_t}^{(0)} {y_{t+1}}^{(0)} = -\mu {y_t}^{(1)} + \lambda, {y_t}^{(1)} \tag{11}$$

Then take the average value of the two times, that is, the product of the quantity becomes $\frac{{y_t}^{(1)} + {y_{t-1}}^{(1)}}{2} {y_{t+1}}^{(0)} = \left(-\frac{{y_t}^{(1)} + {y_{t-1}}^{(1)}}{2}, 1 \right) \binom{\mu}{\lambda}$.

Construct data matrix A and vector matrix B:

$$A = \begin{pmatrix} {y_1}^{(0)} \\ {y_2}^{(0)} \\ \dots \\ {y_{10}}^{(0)} \end{pmatrix}, B = \begin{pmatrix} -\frac{{y_1}^{(1)} + {y_2}^{(1)}}{2} & 1 \\ -\frac{{y_2}^{(1)} + {y_3}^{(1)}}{2} & 1 \\ \dots & \dots \\ -\frac{{y_{n-1}}^{(1)} + {y_n}^{(1)}}{2} & 1 \end{pmatrix} \tag{12}$$

Then the relationship between A and B is that we use the least squares method to estimate the value, bring it into the whitening equation, and solve the differential equation to derive its prediction equation.

$$A = B \binom{\mu}{\lambda} \mu, \lambda \binom{\mu}{\lambda} = (B^T B)^{-1} B^T B A \tag{13}$$

$${y_t}^{(1)} = ({y_1}^{(1)} - \frac{\mu}{\lambda}) e^{-\mu(t-1)} + \frac{\lambda}{\mu} \tag{14}$$

The value of RI is shown in the table:

Table 1. RI values

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.49	1.49

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At the time, we thought we passed the consistency test.

Total ranking selection, $F = w_i x_i$, $i = 1,2,3$.

6. Conclusions and Suggestions

6.1. Conclusions

The investment in environmental pollution control has a positive impact on green total factor productivity. Green total factor productivity is an effective manifestation of the development level of green economy. By increasing the investment in environmental pollution control, economic production can change to a greener and more environmentally friendly direction and promote the rise of the development level of green economy.

6.2. Suggestions

The stability and continuity of policies should be ensured in the process of green transformation. Improve the construction of green investment market and promote free trade of sustainable products. Set an adjustable minimum price for carbon pricing to ensure that the cost of low-carbon transformation is controllable. Unify standards and improve classification and information disclosure mechanisms.

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