Human Capital Threshold Effect of Macroeconomics on the Improvement of Regional Green Innovation Efficiency under Technological Development

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Abstract: The regional difference of the late-developing countries determines the heterogeneity of regional green innovation efficiency, and technology finance and human capital are the key factors affecting the efficiency of regional green innovation. By selecting the panel data of 30 provinces and [1] municipalities in Mainland China from 2008 to 2017, analyze the efficiency level and spatial evolution characteristics of my country's regional green innovation, and explore the impact of technology finance on regional green innovation from the perspective of human capital, and explore the efficiency of green innovation The key influencing factors and mechanism of action. The results show that the level of green innovation efficiency in each province has increased greatly, but the overall level is still at a low-to-medium level, and the regional heterogeneity is significant; technology finance has a significant impact on the efficiency of regional green innovation, and there is a dual threshold effect based on human capital. The positive effect of technology finance on regional green innovation efficiency is based on the premise that the level of human capital reaches the Ill value level; technology finance has a positive spatial spillover effect on regional green innovation efficiency, and the higher the level of human capital, the positive direction of regional technology finance The promotion effect is more pronounced.[2]

1. Introduction

China is the largest developing country in the world. It has advantages in human capital, natural resources and market scale that other countries cannot match. This has promoted the rapid development of the national economy, but it has also produced a serious resource curse and environment. Pollution problem. In this regard, the report of the 19th National Congress of the Communist Party of China made an accurate judgment that my country's economy has shifted from a stage of rapid growth to a stage of high-quality development. With the high-quality transformation of my country's economic growth momentum driven by factor investment to innovation, the latecomer effects of major countries are gradually shifting from speed and scale advantages to quality and efficiency advantages.

2. Theoretical Hypothesis

2.1 The Relationship between Technological Finance Development and Regional Green Innovation

Green innovation efficiency refers to the degree of greenness of regional innovation efficiency taking into account environmental pollution and energy consumption, and is used to measure the quality of innovation development. Regional green innovation is not only an important part of the regional innovation system, but also an important focus of ecological civilization construction and sustainable development. Regional green innovation can effectively overcome the resource crisis and environmental degradation caused by traditional economic development models. The promulgation of the "Guiding Opinions on Building a Market-Oriented Green Technology Innovation System" by the National Development and Reform Commission and the Ministry of Science and Technology indicates that my country's regional green innovation development has entered a new stage. However, regional green innovation is a complex and systematic project. The

characteristics of high risk and high investment determine that regional green innovation cannot only rely on limited enterprise investment and government financial support. The development of technology finance meets the funding needs of regional green innovation. . Technology finance plays an important role in alleviating its financing constraints and promoting more capital flow to technology innovation enterprises or R&D institutions. It can provide capital guarantee for regional green innovation through the allocation of risk-diversified capital. At the same time, greater financing capacity can promote capital the formation of, makes the capital scale and promotes the improvement of regional green innovation efficiency. As early as 1912 [3], Schumpeter studied the role of money, credit and other financial forms in promoting innovation and development. He believed that innovation and finance are inseparable. Later studies by Guarnierit and other scholars also confirmed this view. Some scholars have found that financial development does not have a positive role in promoting innovation activities in all regions, but only after a certain level of innovation activities in a certain region can the financial support role be fully realized. In summary, technology finance also has an important impact on current regional green innovation. Therefore, this article proposes the following assumptions:

H1: Technology finance has a significant impact on the efficiency of my country's regional green innovation [4].

2.2 The Mechanism of Human Capital in the Influence of Technological Finance on Regional Green Innovation Efficiency

The development of science and technology finance provides new financing channels for regional science and technology innovation. However, due to the uneven regional development in my country, there are large differences in economic aggregates, human capital levels, market openness, and policy systems. The absorptive capacity of capital is also different. Among the above factors, the level of human capital directly reflects the ability of industrial and commercial enterprises to absorb new knowledge and new technologies in each region. It is a key influencing factor for transforming scientific and technological financial support into technical support and promoting the efficiency of green innovation [5]. Developed regions, with their own economic strength and location advantages, can attract various financial institutions and foreign capital investment, and can attract a large number of high-quality talents to flow to the region, forming a talent gathering depression, and relying on the region's high-level human capital advantages to absorb More external funds will form a virtuous circle of mutual promotion of funds and talents, so as to give play to the positive role of technology finance in promoting regional green innovation efficiency. Although some underdeveloped areas can obtain certain technical funding support under the government's assistance policies, they lack high-quality talents to participate in scientific and technological research and development, and have problems such as backward innovative thinking and insufficient learning skills, which are likely to cause technical market failures and innovation projects to fail , And cause the waste of scientific research funds, which hinders the improvement of regional green innovation efficiency. Based on this, the following research hypotheses are proposed:

H2a: Under the constraints of human capital, technology finance has a "human capital threshold effect" on the efficiency of regional green innovation;

H2b: Different levels of human capital have different spatial spillover effects of technology finance on regional green innovation efficiency. With the improvement of regional human capital levels, the role of technology finance in promoting regional green innovation efficiency is further strengthened, that is, there is a positive correlation between the two.

3. Indicator Analysis

Green innovation efficiency is a framework that incorporates resource and environmental constraints into the efficiency measurement framework to calculate the input-output ratio of innovation activities based on undesired output [6]. On the basis of its own research, the production function and input-output theory are combined to construct a comprehensive evaluation index system for green innovation efficiency at the provincial level. The definition and calculation of

input-output indicators are as follows: Green innovation efficiency input mainly considers capital input, labor input, and energy input elements. The internal expenditures of R&D expenditures account for the proportion of regional GDP, the full-time equivalent of R&D personnel account for the proportion of employees, and industrial energy consumption. The total amount is measured. Since the internal expenditure of R&D expenditure is determined by the input flow and input stock, the internal expenditure of the R&D expenditure of the current year is used as the input flow to calculate the expenditure stock of the current year as a measure of capital input; the expected output is divided into intermediate output And market output are measured by the number of patents granted per capita and sales revenue of new products, respectively; due to different research focuses, the existing literature has not yet formed a unified view on the measurement of undesired output. At the same time, due to differences in the degree of harm to the environment and the economy of pollutants such as SO2, smoke and solid waste, the undesired output measured by a single indicator as efficiency is often not systematic and comprehensive.

Third, the efficiency of green innovation is showing a trend of "grouping" development. Compared with 2008, the efficiency of green innovation in the western region has improved significantly, and small clusters (new and green) have emerged. The main reason is that, at this stage, the western region is in the accelerated development stage of the grand development strategy, the industrial structure is gradually improved, and characteristic industries have obtained development opportunities. Xinjiang and Qinghai may become new growth poles for the development of green innovation in the western region. The further expansion of the green innovation efficiency agglomeration scope in the Pearl River Delta indicates that the spatial spillover effect and radiation driving effect in this region have been further enhanced, while the Beijing-Tianjin-Hebei and Yangtze River Delta regions have slightly reduced the green innovation efficiency agglomeration scope. The economic level and industrial structure of the surrounding areas are quite different, making it difficult for the affected areas to effectively absorb the positive spillover effects from high-efficiency areas [7].

4. Case Analysis

Human capital is a key factor for companies to transform technology finance into technical support and improve the efficiency of green innovation. For developed regions, due to their own economic advantages and natural location benefits, they can fully attract capital investment from financial institutions and foreign companies. With their high-level human capital advantages, they can make full use of the funds they have absorbed. The positive effect of green innovation efficiency [8]. However, in relatively backward areas, most of the R&D funds for science and technology come from government financial support. There is a clear gap in attracting high-quality talents compared with developed regions. The shortage of talents and medical care often leads to insufficient innovation projects, low innovation efficiency and waste of scientific research funds. It is not conducive to the improvement of green innovation efficiency in the region. Therefore, this article speculates that under different levels of human capital, the marginal impact of technology finance on regional green innovation efficiency may change due to differences in the absorption capacity of scientific research funds, that is, there is a "human capital threshold effect". [9]

5. Conclusion

Aiming at the distortion of the big power effect in my country's regional green innovation, this paper analyzes the effect of technology finance on the efficiency of regional green innovation under the constraint of human capital, and provides a theoretical basis for the development of regional green innovation systems in various regions of our country. The study found that the impact of technology finance on the efficiency of green innovation has human capital threshold characteristics and spatial spillover effects of technology finance. The SBM model including undesired output is used to measure the green innovation efficiency of 30 provinces, municipalities, and autonomous regions in mainland my country from 2008 to 2017. The efficiency measurement results show that

the overall green innovation efficiency in my country is on the rise, but it is still in the middle and low levels. Level, the difference between regions is significant. The regression results show that technology finance can promote the improvement of green innovation efficiency; at the same time, the green innovation efficiency within the region has significant human capital threshold characteristics, which is mainly manifested in the increase of human capital level, the effect of technology finance on green innovation efficiency is inhibited It turns into a weak promotion and finally a medium promotion. At present, 66% of the provinces are in the middle and high level of human capital, indicating that most provinces can achieve a reasonable allocation of scientific research labor and scientific research funds at this stage, and give play to their effectiveness in green innovation. Positive effect. Further analysis found that the technology and finance of neighboring regions or provinces has an innovation spillover effect on the efficiency of green innovation [10].

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