

A Research on GTFP of BRI Countries with DEA Method

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Abstract

The Belt and Road Initiative is an important form of China's participation in international exchanges. General Secretary Xi Jinping proposed an important strategy for green development, and green total factor productivity is an important measure for high-quality development. Based on this, this article first examines the status quo of the Belt and Road participation in green development. Introduce and review relevant domestic and foreign literature. Secondly, build a two-way distance function model for green development to measure the total factor green development rate of participating countries in the Belt and Road; then select relevant variables and use the panel data model to measure the green total factor productivity Regression analysis of influencing factors is carried out, and finally, countermeasures and suggestions for high-quality development of participating countries in the Belt and Road Initiative are proposed.

Keywords

DEA; DDF; BRI; GTFP.

1. INTRODUCTION

The "Belt and Road" initiative was first proposed by Chinese leaders when they visited Central Asia in September 2013. In 2015, various parts of China jointly issued the Vision and Actions for Promoting the Joint Construction of the Silk Road Economic Belt and the 21st Century Maritime Silk Road. The top-level design elaborated on the "Belt and Road" initiative's framework ideas, co-creation, cooperation mechanism, cooperation focus and other aspects. Since then, the "Belt and Road" has entered the stage of comprehensive implementation. As the most important cooperation and development concept in the Asia-Europe sector, the "One Belt One Road" initiative is composed of a series of institutions, cooperation systems and economic entities. It makes full use of the "One Belt One Road" to run through the Eurasian continent, connect the Asia-Pacific economic circle in the east, and enter the European economy in the west. The geographical characteristics of the circle promote the bilateral and multilateral mechanisms of the countries in the region, and fully connect with the existing various regional cooperation platforms, accelerate the regional law and integration, and jointly respond to the challenges of human development, and realize the development and co-prosperity of the countries along the route and China. The "Belt and Road" initiative is a grand strategy based on regional development and common prosperity. It is also an initiative to integrate China's multi-faceted strategic vision, with the help of existing regional cooperation such as the Shanghai Cooperation Organization, the Eurasian Economic Union, and China-ASEAN (10+1). Mechanism, expand organization and inter-regional cooperation while injecting new content and vitality into the development of these organizations. The "Belt and Road" has five main international channels, breaking the original development hotspots that are separated from each other, integrating regional and sub-regional development, connecting existing special economic zones and free trade zones, coordinating development, and regional cooperation, Complementary advantages, work together to accelerate growth. From a domestic perspective, the "Belt and

Road” runs through the eastern and central and western regions and connects major coastal port cities to complete the effective connection with Central Asia and ASEAN. For the interconnection between Chinese provinces and regions, the inheritance and transfer of industries is important. Important strategic significance to help my country's industrial structure upgrade and deep integration with the international value chain. From a global geopolitical and economic perspective, the “Belt and Road” has opened up the land and sea links around China, and deepened regional integration and development.

In this context, it is necessary to conduct an in-depth analysis of the economic development of the countries in the “Belt and Road” region to understand the characteristics of their production activities in order to conduct targeted investment and cooperation. Among them, green total factor productivity, an important economic indicator, is particularly critical for analyzing the economic activities of the “Belt and Road” countries. Green Total Factor Productivity (GTFP) is a core indicator developed in the modern growth theory on the basis of Total Factor Productivity (TFP) to measure the quality of development and reflect the ability of green sustainable development. After China's economy has entered a new normal, higher requirements have been placed on the quality of development. The “Belt and Road” strategy is also one of the means for China to promote economic transformation. Therefore, it is very strategic to conduct research on the green total factor productivity of countries related to the “Belt and Road” initiative. value. Only by proceeding from the basic economic development of the countries related to the “Belt and Road” and rationalizing the influence of the green development factors of the economies of each country can we seek high-quality development of the “Belt and Road” cooperation, conform to the trend of economic development, and achieve the improvement of my country's economic development. Quality, the goal of green and sustainable development. In-depth analysis and research on GTFPs in relevant countries will help improve the pertinence and quality of relevant “Belt and Road” cooperation, strengthen related resource allocation and mechanism guarantees, provide policy support for forward-looking guidance, and promote the improvement of “Belt and Road”. Provide a basis for higher-quality development.

[1] Verlare et al. (2015) published a monograph, expounding the economic development of the “One Belt One Road” strategy for the Central and Eastern European countries represented by Latvia, based on the construction and improvement of infrastructure as the entry point to provide broad growth for the interconnection of the Eurasian continent Space, which brings about the development of industry and economy; [2] Irshad (2015), represented by Pakistan, studied the importance of the promotion of the “Belt and Road” to regional political cooperation and economic development, and pointed out the cooperation in infrastructure, energy and energy. It can enable relevant regions to deeply participate in the global industrial division of labor and has broad development prospects; [3] Hali Shafei Moiz et al. (2017) supported the “Belt and Road” from different economic indicators to enhance China's influence in Central Asia and the conclusion that Pakistan's economic development capabilities ; [4] Chhibber (2017) proposed that as a major country in the “Belt and Road” region, participating in the “Belt and Road” has both pros and cons. There is a long-term competition and cooperation game with China. Although the relevant cooperation agreement is not signed, the framework of the “Belt and Road” can be used. Under the Asian Infrastructure Investment Bank, the Silk Road Fund provides financial support for India and other countries

2. METHODOLOGY

Two-phase directional distance function: characterize carbon dioxide emission reduction behavior. The behavior analysis model based on the directional distance function provides a reasonable framework for describing the behavior of carbon dioxide emission reduction. This

article combines [5] Chen et al. (2014) and [6] Pastor et al. (2011) to define the solution to the infeasible problem, and consider the two-phase directionality of energy and environmental factors and the relaxation effects of input, expected output and undesired output Distance function (Biennial Directional Distance Function, BDDF), and select the direction vector to standardize the factor slack, and incorporate the idea of carbon dioxide emission reduction into the analysis framework of green total factor productivity, so as to describe the path to improve the efficiency of decision-making units under the constraint of carbon dioxide emission reduction, namely Efficiency is improved along the direction of expected output increase and input and undesired output decrease. The impact of carbon dioxide emission reduction behavior on green total factor productivity is analyzed:

$$\bar{D}_j^B(x, y, b; g_y, g_b) = \sup \left\{ \beta_j^B : \beta_j^B = \sum_{m=1}^M \beta_{jm}^B + \sum_{q=1}^Q \beta_{jq}^B + \sum_{h=1}^H \beta_{jh}^B \in p(x) \right\}$$

Among them, represents the two-phase production technology, which is the total two-phase directional distance function of the evaluated object, and,, and are respectively the two-phase directional distance function of input, expected output and undesired output. The two-period directional distance function is an indicator to measure the level of inefficiency. Its value can be calculated by constructing a linear programming. The larger the value, the lower the efficiency, and vice versa. The linear programming corresponding to the two-period directional distance function under variable returns to scale in a certain province in the period is:

$$\bar{D}_{jv}^{Bt}(x^t, y^t, b^t; g^t) = \beta_{jv}^{Bt} = \text{Max} \frac{1}{2} \left\{ \left[\frac{1}{2M} \left(\frac{S_{jl}^{Bt}}{g_{jl}^t} + \frac{S_{jk}^{Bt}}{g_{jk}^t} + \frac{S_{je}^{Bt}}{g_{je}^t} \right) + \frac{1}{2(Q+H)} \left(\frac{S_{jy}^{Bt}}{g_{jy}^t} + \frac{S_{jd}^{Bt}}{g_{jd}^t} + \frac{S_{js}^{Bt}}{g_{js}^t} \right) \right] + \left[\frac{1}{3M} \left(\frac{S_{jl}^{Bt}}{g_{jl}^t} + \frac{S_{jk}^{Bt}}{g_{jk}^t} + \frac{S_{je}^{Bt}}{g_{je}^t} \right) + \frac{1}{3Q} \left(\frac{S_{jy}^{Bt}}{g_{jy}^t} \right) + \frac{1}{3H} \left(\frac{S_{jd}^{Bt}}{g_{jd}^t} + \frac{S_{js}^{Bt}}{g_{js}^t} \right) \right] \right\}$$

$$s.t. \sum_{j=1}^J Z_j^t y_j^t + \sum_{j=1}^J Z_j^{t+1} y_j^{t+1} \geq y_{j^t}^t + S_{j^t y}^{Bt}$$

$$\sum_{j=1}^J Z_j^t d_j^t + \sum_{j=1}^J Z_j^{t+1} d_j^{t+1} = d_{j^t}^t - S_{j^t d}^{Bt}$$

$$\sum_{j=1}^J Z_j^t s_j^t + \sum_{j=1}^J Z_j^{t+1} s_j^{t+1} = s_{j^t}^t - S_{j^t s}^{Bt}$$

$$\sum_{j=1}^J Z_j^t l_j^t + \sum_{j=1}^J Z_j^{t+1} l_j^{t+1} \leq l_{j^t}^t - S_{j^t l}^{Bt}$$

$$\sum_{j=1}^J Z_j^t k_j^t + \sum_{j=1}^J Z_j^{t+1} k_j^{t+1} \leq k_{j^t}^t - S_{j^t k}^{Bt}$$

$$\sum_{j=1}^J Z_j^t e_j^t + \sum_{j=1}^J Z_j^{t+1} e_j^{t+1} \leq e_{j^t}^t - S_{j^t e}^{Bt}$$

$$Z_j \geq 0; S_{j^t y}^{Bt} \geq 0; S_{j^t d}^{Bt} \geq 0; S_{j^t s}^{Bt} \geq 0; S_{j^t l}^{Bt} \geq 0; S_{j^t k}^{Bt} \geq 0; S_{j^t e}^{Bt} \geq 0; \sum_{j=1}^J Z_j + \sum_{j=1}^J Z_j^{t+1} = 1; j = 1, \dots, J.$$

3. RESULT AND DISCUSSION

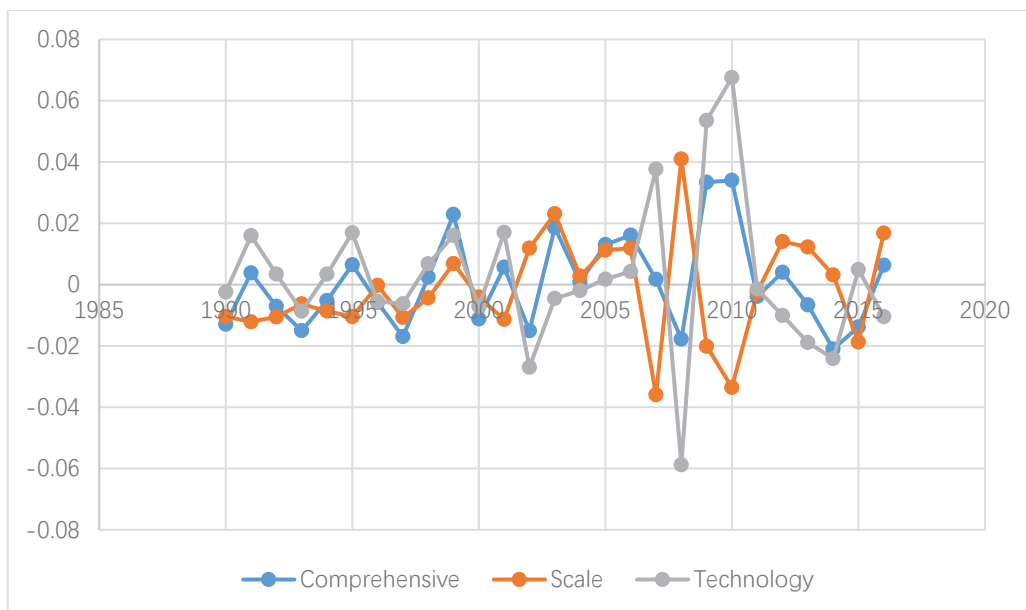


Figure 1. Efficiency and its decomposition

From the above figure, we can see that the green all-factor production efficiency calculated by the “Belt and Road” countries is average and fluctuates. From 1990 to 2003, green total factor productivity was on a growing trend, with increasing peaks. Since 2003, the frequency of fluctuations has increased, and the absolute values of peaks and valleys have increased. Since 2010, there has been a trend of slower fluctuations, which indicates that the “Belt and Road” countries are not efficient in transforming natural consumption into social welfare. On the one hand, most of the “Belt and Road” countries are mainly developing and underdeveloped countries. In recent years, The economy has developed rapidly in the past, but the industrial development model is relatively extensive, the consumption of resources is serious, and the efficiency of resource utilization is low. From the perspective of scale efficiency, the change of scale efficiency and the overall efficiency show the same change trend. From 1990, the overall efficiency is greater than the scale efficiency. With the continuous development of the economies of the Belt and Road countries, the scale efficiency gradually plays an important role in the overall efficiency. The absolute value of efficiency is greater than the absolute value of overall efficiency. From the perspective of technical efficiency, the absolute value of the technical efficiency of 41 countries along the Belt and Road is higher than the overall efficiency and scale efficiency, indicating that the trend of technological efficiency changes in the countries along the Belt and Road is unstable, and it is still necessary to increase technological investment and continuously improve the technology of products.

Based on the aforementioned research results, the following relevant suggestions are put forward: Attach importance to relevant technological innovation and investment, and promote the high-speed and high-quality development of the international economy related to the “Belt and Road”. From the research results, after participating in the “Belt and Road” related cooperation, the economy of relevant countries has increased to varying degrees, the consumption of natural resources has increased, and the efficiency of its transformation into social welfare is not high. This is not only related to the industrial structure of the relevant country, but also The overall social operating mechanism is related. Therefore, it is necessary to promote relevant countries to change the extensive industrial model, strictly restrict the establishment and expansion of enterprises with serious resource consumption, and at the same time further improve resource utilization through various technical means, and increase

the contribution of scale ratio to green total factor productivity. At the same time, the fluctuation of national technical efficiency indicates that its contribution to green total factor productivity is unstable. Therefore, it is necessary to strengthen technological innovation and continue to support technological upgrading to improve the technical efficiency of relevant national economies.

Strengthen investment in green industries along the "Belt and Road" initiative. The empirical results show that the slow economic growth of the relevant countries has led to the limitation of capital growth, and the capital saving effect has a low contribution to the green total factor productivity. Therefore, it is necessary to strengthen the soundness and development of the "Belt and Road" related financial mechanisms, expand financing and investment, and effectively supervise the related financing and investment platforms, so that the related financing and investment mechanisms can grow vigorously, so as to promote the improvement of green total factor productivity. Specific measures may include encouraging the "Belt and Road" participating countries to jointly strengthen financial infrastructure, promote the training and flow of financial talents in the region, negotiate and promote the expansion of investment channels in relevant countries, actively introduce funds from foreign financial institutions, and make good use of international regional Policy loans, establishment of third-party investment channels, expansion of preferential interest rates for related projects, and promotion of the efficiency of financial services.

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