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Empirical Research on Rural Financial Efficiency of the Yellow River Basin

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Abstract

Since ancient times, the Yellow River Basin has been the most prosperous area of agricultural economy. With the advancement of ecological protection and high-quality development in the Yellow River Basin, the establishment of the Yellow River Basin Economic Belt. In response to the country's construction of the Yellow River Basin Economic Belt, this paper uses the DEA method and establishes an SBM model to support rural economic development in the Yellow River Basin. Carry out empirical research on the efficiency of the country, and conduct an in-depth analysis of slack in various regions. The research results show that the rural financial efficiency of the Yellow River Basin is generally at a low level, and the pure technical efficiency needs to be improved. Improving the efficiency of fund use is the key to solving the problem of low rural financial efficiency in the Yellow River Basin.

Keywords

Yellow River Basin, rural financial efficiency, SBM model.

1. Introduction

On September 18th, President Jinpin Xi. hosted a symposium on ecological protection and high-quality development of the Yellow River Basin in Zhengzhou and delivered an important speech, emphasizing the importance of establishing the Yellow River Basin Economic Belt and promoting the economic development of the Yellow River Basin as a national strategy. All provinces have responded to the call of President Jinpin Xi. and made full preparations for promoting the ecological protection and high-quality development of the Yellow River Basin. my country has a vast territory, and the development of each region has its own characteristics and themes. At the meeting, President Xi emphasized that development should be adapted to local conditions, agriculture is suitable for agriculture, and work is suitable for work. The Yellow River Basin has been dominated by agriculture since ancient times. Promoting the development of the rural economy is crucial to achieving the goal of high-quality development, and rural finance is an important factor in promoting the development of the rural economy.

2. Literature Review

In the research of this article, the concept of rural area does not refer to a specific location, but is only a synonym for a relatively underdeveloped region. Relatively speaking, there are more developed countries in the West, and finance started earlier. Both the financial market and the financial system Relatively complete, and the research literature is relatively old. In the current situation of rapid changes in the international and domestic environment, many literatures are not of great reference value. However, there are also relative references. For example, Asif Khan and Rachita Gulati (2019) used DEA's research methods to conduct an empirical study on the financial, social and overall bias corrected efficiency of 82 Indian microfinance institutions from

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2015 to 2016. The results show that the size of MFIs and the equity-to-asset ratio in the study year affected the efficiency level of Indian MFIs.

In the domestic research on rural financial efficiency, some scholars have made an overall analysis of the overall rural financial efficiency from a national perspective. For example, Zhang Yiqing and Peng Fei (2016) established a four-stage DEA-Tobit model for the analysis of 31 provinces across the country. An empirical analysis of rural financial efficiency shows that there are regional differences in rural financial efficiency in my country, and rural financial efficiency in the western region is significantly lower than that in the central and eastern regions. Chen Li (2018) used the DEA method to empirically analyze the overall rural financial efficiency level in my country from 1990 to 2014. It is found that my country's rural financial efficiency has been steadily improved during this period, and it is proposed that deepening financial reform is to promote the maximization of rural financial efficiency. Chen Xiao, Song Junjun (2018) used an empirical analysis of how rural financial efficiency affects farmers' income and found that the improvement of rural financial efficiency in different regions is brought about by different influencing factors, but they can all promote the growth of farmers' income. There is just a difference in degree.

On the basis of the above-mentioned scholars' research, this paper uses DEA method to study the rural financial efficiency of the Yellow River Basin, which is currently focused on, in order to discover the influencing factors of rural financial efficiency in the Yellow River Basin and respond to the country's call for vigorously developing the Yellow River Basin.

3. SBM Model

The financial efficiency studied in this article refers to the benefits of rural economic development brought about by investing certain financial resources, such as manpower, material resources, and financial resources, to meet the model principles of the DEA method. In order to obtain more accurate and scientific calculation results, this paper selects the SBM model to process and analyze the data.

SBM model (Slack Based Model) Tone K proposed a non-radial DEA model. It is based on the traditional DEA model, and solves the problem of efficiency deviation caused by the traditional DEA model's inability to measure all slack variables and the choice of input-output angle and radial, making the analysis results more accurate. The SBM model of the output direction can ensure that the output is expanded under the existing input.

Suppose there are n decision-making units (DMU for short), expressed as DMU_j (j=1,2,...,n). x and y are input and output variables respectively, denoted as, $x \in R^m$, $y \in R^h$,then the input matrix is X=[x_1 ,..., x_n] $\in R^{m\times n}$, Y=[y_1 ,..., y_n] $\in R^{h\times n}$, where x>0, y>0. If it is assumed that the return to scale is constant, the production possibility set is:

$$P = \{(x, y) | x \geq X\lambda, y \geq Y\lambda, \lambda \geq 0\} \tag{1}$$

According to the SBM model proposed by Tone K, its expression is:

$$\rho = \min \frac{1-(1/m)\sum_{i=1}^{m} s_i^- / x_{i0}}{1+(1/h)\sum_{r=1}^{h} s_r^+ / y_{r0}} \tag{2}$$

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$$s.t.\begin{cases} x_0 = X\lambda + s^- \\ y_0 = Y\lambda - s^+ \\ \lambda \geq 0, s^- \geq 0, s^+ \geq 0 \end{cases} \quad (3)$$

Among them, ρ represents the objective function, and its value is the desired efficiency value, so $0 \leq \rho \leq 1$ λ represents the weight, s is the slack variation of input and output, which is strictly monotonically decreasing, and m and h represent input, Types of output factors. x_{r0} and y_{r0} are the i-th index value of vector x_0 and the r-th index value of vector, respectively y_0. Only when $\rho=1$, the corresponding DMU is efficient. When $\rho<1$, the DMU is ineffective, and the corresponding s^- or s^+ is not 0, indicating that there is room for improvement in terms of input or output.

4. Index Selection and Data Description

4.1. Selection of Indicators

In this paper, when using the DEA method to measure the rural financial efficiency of the Yellow River Basin, the panel data of the nine provinces involved in the Yellow River Basin from 2010 to 2018 are used as samples. The data of each province was collected and processed as a control group for analysis. This article starts with two aspects of human resources and financial resources, comprehensively considering the statistical caliber of each province, and under the premise of ensuring the availability and reliability of the data, the following indicators are selected for statistical analysis of the rural financial efficiency of each province

Table 1: Evaluation indicators of rural financial efficiency

Index	Indicator name
Investment index	Rural agriculture-related loans
	Total financial support for agriculture
	Number of employees in rural financial institutions
Output indicators	Per capita income of farmers
	Primary industry added value

4.2. Data Description

All data in this article are from the 2011-2019 Provincial Statistical Yearbook, "China Financial Yearbook", "China Rural Statistical Yearbook", and "Shanghai Financial Budget Report". Since the data required for this study involves various provinces across the country, the statistical content is different in terms of caliber. Therefore, some data cannot be directly obtained when selecting specific data. For example, after 2010, the classification structure of short-term loans of many financial institutions has changed, not alone. The indicator of agricultural loans is set up, so the data on agricultural loans are derived from the economic and social development reports of the provinces and other relevant data.

5. Empirical Results and Analysis

This article uses MAXDEA software to process the collected data, and finally obtains the comprehensive evaluation results of the national regions from 2010 to 2018 in Table 2, where TE stands for comprehensive technical efficiency, PTE stands for pure technical efficiency, and SE stands for scale efficiency.

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Table 2: 2010-2018 average comprehensive technical efficiency, pure technical efficiency and scale efficiency of each region

Region	TE	PTE	SE	Region	TE	PTE	SE
Qinghai	0.664	0.807	0.839	Jiangsu	0.946	1	0.946
Sichuan	0.395	0.405	0.972	Zhejiang	0.792	0.868	0.912
Gansu	0.381	0.428	0.891	Anhui	0.651	0.654	0.994
Ningxia	0.652	0.722	0.917	Fujian	0.813	0.812	0.973
Neimenggu	0.469	0.472	0.992	Jiangxi	0.482	0.488	0.985
Shaanxi	0.381	0.413	0.915	Hubei	0.755	0.762	0.988
Shanxi	0.259	0.284	0.914	Hunan	0.723	0.727	0.993
Henan	0.603	0.615	0.972	Guangdong	0.671	0.702	0.957
Shandong	1	1	1	Guangxi	0.728	0.741	0.979
Beijing	0.901	0.951	0.948	Hainan	1	1	1
Tianjin	1	1	1	Chongqing	0.449	0.465	0.969
Hebei	0.881	0.888	0.985	Guizhou	0.453	0.481	0.931
Liaoning	0.607	0.621	0.972	Yunnan	0.511	0.521	0.977
Jilin	0.955	0.984	0.966	Xizang	1	1	1
Heilong	0.796	0.809	0.981	Xinjiang	0.697	0.703	0.989
Shanghai	1	1	1	Nation	0.774	1	0.774

5.1. Comprehensive Technical Efficiency Analysis

Comprehensive technical efficiency measures the comprehensive ability of various decision-making units to use various input resources to transform into output. According to the definition of the efficiency value in the DEA method, the efficiency value is between 0 and 1. The larger the value, the higher the efficiency, which means that the input brings more output, and 1 means that the decision-making unit is on the effective front line. From the calculation results in Table 2, the comprehensive technical efficiency value of Shandong, Tianjin, Shanghai, Hainan, and Tibet is all 1, which is on the effective front line, and the efficiency of financial resource input and utilization has reached the optimal state. The national comprehensive technical efficiency value is 0.674. The efficiency of Beijing, Hebei, Jilin, Jiangsu, and Fujian are all above 0.8, and the level of rural financial development is relatively high. In contrast, in the Yellow River Basin, its average comprehensive technical efficiency value is only 0.534, which is below the national average efficiency value. Among the nine regions included, except for Shandong Province, which has a comprehensive technical efficiency value of 1, the rest are all lower than the national average. The efficiency value shows that there is still a lot of room for development of rural finance in the Yellow River Basin.

5.2. Pure Technical Efficiency Analysis

Pure technical efficiency refers to the ability of transforming inputs into outputs of various regions simply from the financial resource utilization technology and management capabilities of the rural areas in each region after the comprehensive technical efficiency excludes the scale efficiency. Analyzed from the specific calculation results in Table 2, the national pure technical efficiency value is 1, which is on the effective front line, indicating that the overall average pure technical efficiency in the country is in an effective state. At the same time, Shandong, Tianjin, and Shanghai have a pure technical efficiency of 1. Based on the comprehensive technical efficiency analysis of these six provinces in the six regions of Hainan, Hainan, Tibet, and Jiangsu, the rural financial development in these regions is in good condition, and the utilization efficiency of financial resources is in the optimal state. However, eight of the nine regions in the Yellow River Basin have their pure technical efficiency ineffective. The fundamental reason is

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that the overall economy of these regions is relatively underdeveloped compared to other regions. From a geographical point of view, except for Shandong Province, which belongs to the coastal area, all other provinces are inland. Throughout the course of economic development in China, the focus was first on the development of coastal areas, and then on "Western Development" and "Rejuvenation of the Old Northeast Industrial Base", but there has been no development plan specifically targeting inland areas. Therefore, the pure technical efficiency of the Yellow River Basin has great potential for development.

5.3. Scale Efficiency Analysis

Scale efficiency is used to measure whether the existing output scale structure of each decision-making unit is effective, and the efficiency value reflects the gap with the optimal output scale structure. When the value of the scale efficiency of the decision-making unit is closer to 1, it means that the rural financial scale in the region is closer to the optimal output scale. From the specific calculation results in Table 2, the scale efficiency values of various regions across the country are generally at a high level, with a national average of 0.774. The regions on the frontline of the effective scale efficiency include Shandong, Tianjin, Shanghai, Hainan, and Tibet. Values are all 1, and the scale efficiency values of other regions are also above 0.9. The average efficiency value of the Yellow River Basin is 0.935, which is basically close to the effective value. It shows that the rural financial scale structure in many regions is not in the optimal output scale, but basically Still reasonable. We have learned that comprehensive technical efficiency is the product of pure technical efficiency and scale efficiency. Based on the above analysis of comprehensive technical efficiency and pure technical efficiency in various regions, it can be seen that the comprehensive technical efficiency in many regions is not high because of pure technical efficiency. At a low level, this shows that all regions must improve the overall technical efficiency of rural finance, pay attention to the development and promotion of technology, and increase investment in technology for effective use.

6. Conclusion and Suggestion

Combining the above empirical results and specific analysis, the research conclusions and policy recommendations of this article are as follows:

First, From the overall results, the rural financial efficiency of the Yellow River Basin is generally at a relatively low level. Only Shandong Province is active. Judging from the result of redundant input and insufficient output in ineffective areas, it is important to focus on the pure technical efficiency of these areas when improving the rural financial efficiency of the Yellow River Basin. When adjusting the development strategy, pay attention to the reform of the management system of rural financial institutions, pay attention to the basic training of practitioners, improve the efficiency and quality of business handling, and actively respond to the country's "call for the promotion of high-quality development in the Yellow River Basin".

Second, the efficiency of capital use is an important factor affecting the efficiency of rural finance. When analyzing the data processing results of the nine regions in the Yellow River Basin, it was found that there was a lot of redundancy in capital investment, indicating that compared with the current output, the capital investment was too much, that is, the existing capital investment can bring more output. This means that the efficiency of capital utilization is insufficient and there is a lot of room for improvement. In the face of this situation, financial institutions should improve the fund management system and strengthen the management of funds to increase the efficiency of fund utilization, ultimately improve the efficiency of rural finance, and promote the economic development of the Yellow River Basin.

Third, adapting measures to local conditions is an effective way to improve rural financial efficiency. The Yellow River Basin is located in the Central Plains and is rich in resources. It can

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be seen from the research results that the main reason for the low overall technical efficiency of the Yellow River Basin is that the pure technical efficiency needs to be improved. Therefore, according to the characteristics of each region of the Yellow River Basin, it is suitable for the rural areas of the region. Financial management technology is an effective way to improve pure technical efficiency.

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