

Evaluation on the Efficiency of Various Investments in Promoting Rural Revitalization in 16 Cities of Anhui Province based on DEA

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Abstract

Under the national strategic background of regional integration development in the Yangtze River Delta, Anhui Province, as a major agricultural province, will continue to implement the Rural Revitalization Strategy. Whether it is the implementation of the Rural Revitalization Strategy or the conclusion of targeted poverty alleviation, sufficient funds are needed. This paper empirically analyzes the efficiency level of different types of investment and financing in Anhui Province, so as to put forward suggestions for Promoting Rural Revitalization and effectively improving farmers' per capita disposable income, which is of great significance to the development of rural economy in Anhui Province.

Keywords

Investment; Rural Vitalization Efficiency Evaluation; DEA.

1. Introduction

At present, agriculture in Anhui Province is large but not strong, rural construction lags behind, and there are many historical arrears in rural infrastructure and public service facilities. Therefore, the task of comprehensively promoting rural revitalization is arduous. At the same time, the financial resources of the government are weak, the income level of farmers is low, and the inflow of industrial and commercial capital is relatively small. Rural Revitalization faces a severe capital bottleneck. Clarifying the efficiency level of various investments in 16 cities in the province to promote rural revitalization, accelerating the reform and innovation of rural investment and financing, and broadening the investment and financing channels of "agriculture, rural areas and farmers" have important practical significance for Anhui Province to solve the investment and financing problems of Rural Revitalization and comprehensively promote the Rural Revitalization Strategy.

The sources of rural construction funds of cities in Anhui Province are mainly composed of financial and social investment. With the continuous advancement of the work of "agriculture, rural areas and farmers", Anhui focuses on industrial development, living environment, infrastructure and public services [1]. The investment in agriculture and rural areas is increasing, and the financial expenditure is increasing. Rural roads, power supply, water supply, communication and other infrastructure have been continuously improved, remarkable achievements have been made in the construction of livelihood projects such as housing, education and medical treatment, and domestic garbage and sewage have been effectively treated. On the other hand, social capital has accelerated to the countryside and become an important force to promote rural revitalization. More than 150000 entities of social capital went to the countryside, with a cumulative investment of more than 2 trillion yuan. From the perspective of investment potential, social capital can not only invest in the development of rural industries, but also participate in the construction of infrastructure with certain benefits such as storage and preservation of agricultural products, cold chain logistics, high-standard

farmland and rural sewage treatment, but also develop service industries such as village planning, education and elderly care, rural tourism and e-commerce consumption. From the perspective of investment conditions, rural transportation, communication, information and other infrastructure have been continuously improved, logistics and transportation are more convenient, and labor, land and other costs are relatively low.

The CPC Central Committee and the State Council attach great importance to guiding social capital to invest in agriculture and rural areas. The Political Bureau of the CPC Central Committee analyzed and studied the current economic situation and deployed the current economic work, and clearly required to do a solid job in the "six stability" work, including "stable investment", and implement the task of "six guarantees" [2]. In recent years, a series of policy documents, such as the No. 1 central document of the Central Committee and the strategic plan for Rural Revitalization issued by the office of the Central Committee and the State Council, have also made clear requirements for this. To implement the central decision-making and deployment, we need to formulate a guiding document, clarify the key points, innovate the model, create an atmosphere, and guide social capital to enter agriculture and rural areas in an orderly manner.

2. Current Situation and Problems of Rural Revitalization and Investment

2.1. Development Background

The fundamental goal of implementing the Rural Revitalization Strategy is to achieve "farmers are rich, agriculture is strong and rural beauty", which involves many aspects such as rural economy and culture. It needs to invest a huge amount of funds, and it is difficult to plan the use of funds. In the current severe economic situation, due to various restrictive conditions, it is difficult for multiple investors to provide the huge amount of funds needed to support rural revitalization, which makes it difficult to further carry out the Rural Revitalization Strategy and restricts the development of Rural Revitalization.

In order to boost rural construction and build a diversified investment pattern for rural revitalization, the Ministry of agriculture and rural areas has successively issued policy documents [3]. On the one hand, increase government expenditure and invest a lot of funds to support rural construction through national and local finance. On the other hand, encourage and guide social capital to the countryside and boost rural construction. To implement the Rural Revitalization Strategy and give priority to the development of agriculture and rural areas, in addition to further increasing financial investment, we also need to stimulate the vitality of social capital investment and better meet the diversified investment and financing needs.

Although fiscal expenditure can increase the amount of loans available to farmers and promote farmers to increase their capital investment in production, it does not play an effective role in promoting rural economic development. We should strengthen the policy guidance of fiscal support for agriculture on rural development. Therefore, farmers should strengthen the division of labor and cooperation with new business entities such as cooperatives and agricultural enterprises, give play to their advantages of guiding the flow of factors, introducing advanced business philosophy and brand operation, increase investment in rural revitalization, improve their own cultural quality and skill level, and cultivate professional and compound talents in industrial integration.

Social capital is an important force to promote the implementation of Rural Revitalization Strategy. As the most active element in the national economy, social capital accounts for more than 80% of the fixed asset investment in the primary industry. It can also inject modern production factors such as talents, technology and management into agriculture and rural areas, which is conducive to accelerating the establishment of a modern agricultural industrial system, production system and management system. However, since last year, China's agricultural fixed

asset investment has remained in the doldrums. Affected by the outbreak of the epidemic, the investment in fixed assets in the primary industry has been declining. It is urgent to strengthen policy guidance, boost investment confidence, guide, serve and protect the enthusiasm of social capital to invest in agriculture and rural areas.

Social capital investment in agriculture and rural areas needs to further optimize services and precise guidance. At present, social capital investment in agriculture and rural areas shows a trend of more diversified investment subjects, more diversified investment modes and more extensive investment fields. However, at the same time, there are still some practical difficulties in policies and mechanisms. We need to deepen the reform of "release, management and service", create a market environment of fair competition, stabilize market expectations, unblock investment channels, and help solve the problem of "where does money come from" in rural revitalization.

2.2. Development Status

In recent years, the construction of rural economic and financial infrastructure in Anhui Province has been continuously improved, attracting investment services and realizing full coverage of administrative villages. The construction of rural credit system has achieved remarkable results, and more than 90% of farmers' credit information has been entered into the rural credit information platform. A large number of "agriculture, rural areas and farmers" financial products have emerged, such as agricultural easy loans, poverty alleviation micro loans, "e-commerce e-agricultural loans", and rural financial products and services have been continuously innovated. At the same time, Anhui has actively explored the effective method of "separation of three rights" of rural land, and the circulation rate of rural contracted cultivated land has reached 45.5%, which has laid a solid foundation for the development of various agricultural and rural investment subjects. On the other hand, Anhui has vigorously expanded the channels of rural direct financing and social financing, and the level of social capital participation in rural construction has been continuously improved.

Nowadays, the innovation of rural investment and financing in Anhui is changing with each passing day, the role of insurance and guarantee in increasing credit is increasing, and funds, bonds and other products are becoming more and more abundant [3]. The transformation and upgrading of agricultural insurance was accelerated, and financial and insurance institutions were encouraged to carry out the policy pledge loan business of agricultural business entities, adopting the "532 model" or the "4321" government bank model of "insurance companies + risk funds + banks" risk sharing. The policy investment and financing guarantee system has been continuously improved, 140 policy guarantee institutions in provinces, cities and counties have realized three-level linkage and complementarity, and the agricultural guarantee "persuading farming loans" model has been popularized in the whole province[4]. Vigorously promote the purchase of services by the government, strengthen the cooperation between the government and social capital, and constantly innovate the construction and operation mode of rural infrastructure.

2.3. Existing Problems

(1) The scale of investment and financing is relatively small. The investment scale of agriculture, forestry, animal husbandry and fishery in Anhui accounts for a small proportion of all fixed asset investment, and the proportion of agriculture related loans in all loans is also lower than the general level of other six neighboring central provinces such as Hunan and Henan.

(2) Anhui agricultural and rural investment relies heavily on financial funds, and the ability to use bank loans is low. Rural funds mainly come from farmers' own funds, less capital market and utilization of foreign capital, and narrow market-oriented financing channels.

(3) The main investors in agriculture are still farmers or collective economic organizations. The investment in rural tertiary industry grows slowly. There are few investors in rural tourism and home stay, rural e-commerce and agricultural socialized services. The main investors in rural water conservancy, transportation and other infrastructure investment and environmental governance are still the government.

(4) The regional investment and financing gap in Anhui Province is large, and the per capita agricultural investment gap is obvious.

3. Research Design

3.1. Research Method

In 1978, A. Charnes, W. W. Cooper and E. Rhodes founded DEA (Data Envelopment Analysis) model, namely CCR model. DEA model is a nonparametric model widely used to test and evaluate the efficiency of decision-making unit (DUM). It uses envelope instead of production function and takes advantage of its own advantages in technology and scale to realize evaluation research. The CCR model assumes that the return to scale remains unchanged, and the technical efficiency (TE) obtained by the model includes the component of scale efficiency. In 1984, R.D. Banker improved the CCR model to obtain the BCC model with variable returns to scale, which can obtain pure technical efficiency (PTE). The scale efficiency (SE) is obtained by the ratio of CCR model efficiency to BCC model efficiency, that is, $SE = TE / PTE$.

Assuming that the measurement object is n DUMs, it is recorded as DUM_j ($j = 1, 2, \dots, n$); Each DUM has m inputs, which are recorded as X_i ($i = 1, 2, \dots, m$), the weight of input is expressed as v_i ; q outputs, recorded as y_r ($r = 1, 2, \dots, q$), the weight of output is expressed as u_r . Then, for the DUM_k to be calculated, its model can be expressed as:

$$\begin{cases} \min \theta \\ s. t. \sum_{j=1}^n \gamma_j x_{ij} = \theta x_{ik} \\ \sum_{j=1}^n \gamma_j x_{ij} = y_{rk} \\ \sum_{j=1}^n \gamma_j = 1, \gamma \geq 0 \\ i = 1, 2, \dots, m; r = 1, 2, \dots, q; j = 1, 2, \dots, n. \end{cases} \quad (1)$$

3.2. Index Selection and Data Source

3.2.1. Introduction to Relevant Indicators

(1) Decision making unit. As poverty alleviation achieved a complete victory in 2020, rural revitalization is regarded as the guiding ideology and forward goal of domestic rural development in the new period. Therefore, according to the statistical yearbook of Anhui Province, sectional data of each city in 2020, i.e., 2019, are selected for analysis.

(2) Input indicators. This paper selects the sources of foreign investment, fiscal expenditure and real estate investment in each city as the investment indicators to promote rural revitalization and development. Since the main sources of rural investment are government financial expenditure and social investment, the financial expenditure and two representative social investments are selected. It is obvious that local economic growth depends on the real estate industry to drive GDP. At the same time, foreign investment in the mainland has been increasing in recent years, which has played an increasingly prominent role in local economic development and further rural revitalization and construction.

(3) Output indicators. The most intuitive manifestation of Rural Revitalization is the improvement of farmers' living standards and prosperity. Therefore, this paper selects the per capita disposable income of rural residents as the output index.

3.2.2. Descriptive Statistical Analysis of Input and Output Indicators

The following table is a descriptive statistical analysis of input and output indicators of Rural Revitalization in Anhui Province in 2019. It can be seen from table 1 that during the study period, the standard deviation of rural residents' per capita disposable income, foreign investment, fiscal expenditure and real estate investment sources is large. It can be seen that the development of Rural Revitalization in Anhui Province is not stable.

Table 1. Descriptive statistics

Index	Average value	Standard deviation	Minimum value	Maximum value
Disposable income	16407.625	3387.769378	13079	23473
Foreign investment	112104.625	98934.06496	21415	339150
Expenditure	3997046.313	2315466.849	1646024	11226669
Real estate investment	7284079.188	7989490.574	1271653	36180273

4. Evaluation Results and Analysis

This paper adopts DEAP2.1. The software application investment oriented VRS model calculates the Rural Revitalization and development efficiency of various cities in Anhui Province in 2019. The calculation results are shown in Table 2.

Table 2. Evaluation results

Region	crste	vrste	scale	
Hefei	0.205	0.957	0.214	drs
Huaibei	0.823	0.834	0.987	drs
Bozhou	0.386	0.744	0.519	drs
Suzhou	0.307	0.695	0.442	drs
Bengbu	0.505	0.828	0.610	drs
Fuyang	0.364	0.743	0.490	drs
Huainan	0.624	0.827	0.755	drs
Chuzhou	0.325	0.711	0.457	drs
Lu'an	0.322	0.742	0.434	drs
Ma'anshan	0.947	1.000	0.947	drs
Wuhu	0.463	0.969	0.478	drs
Xuancheng	0.551	0.895	0.615	drs
Tongling	0.962	0.971	0.991	drs
Chizhou	1.000	1.000	1.000	-
Anqing	0.584	0.833	0.701	drs
Huangshan	1.000	1.000	1.000	-

According to the standard of efficiency evaluation index in DEA model, the efficiency value is between 0-1. The greater the efficiency value, the higher the efficiency of investment and financing for the revitalization and development of urban and rural areas. The average values of Rural Revitalization and development comprehensive efficiency (crste), pure technical efficiency (vrste) and scale efficiency (scale) of cities in Anhui Province in 2019 are 0.586, 0.859 and 0.665 respectively. The comprehensive efficiency and scale efficiency are low, and the pure technical efficiency is high.

According to the analysis results, the comprehensive efficiency of Rural Revitalization and development in Chizhou and Huangshan is relatively high, while the comprehensive efficiency of Hefei is only 20.5%, ranking at the bottom of the province. In recent years, Anhui Province has been increasing its efforts to build Hefei metropolitan area, and all kinds of investment and financial expenditure rank first in the province. However, the investment cycle is short, there is

a large space to improve the efficiency of various resources, and the effect has not been fully shown. According to regions, the comprehensive efficiency of Northern Anhui cities such as Bozhou, Suzhou, Fuyang and Chuzhou is in a lower position in the province. There are many resources invested in Northern Anhui, but the underdevelopment problem in rural areas is serious, and the rural population is huge, resulting in the low disposable income of rural residents. In contrast, in southern Anhui, such as Chizhou and Huangshan, although there is less inclination to accept foreign investment and other resources, the utilization efficiency of investment and financing is high.

Ma'anshan, Chizhou and Huangshan are in the forefront of the province in terms of pure technical efficiency, and other cities are also at a high level. However, there are great differences in the scale efficiency among cities. Except Chizhou and Huangshan, the scale efficiency is in the stage of diminishing returns to scale, which shows that the utilization efficiency of investment and financing in each city is low. While continuing to absorb all kinds of resources, we should pay more attention to the structure of resource distribution, optimize the utilization and improve the efficiency of resource utilization.

5. Conclusions and Suggestions

This paper adopts DEAP2.1. The software calculates the efficiency level of various investment and financing to promote rural revitalization in various cities of Anhui Province in 2019. The results show that the comprehensive efficiency of Rural Revitalization in various cities of Anhui Province is quite different, and the utilization efficiency in different regions is quite different, the development is unbalanced, the pure technical efficiency has been relatively high, the scale efficiency is widely different, and they are basically in the stage of diminishing returns to scale. It shows that the overall Rural Revitalization in Anhui Province has attracted strong investment and financing resources, but the overall development level is uneven, and the resource advantages have not been fully transformed into the effectiveness of rural development. The comprehensive efficiency and scale efficiency of Rural Revitalization in Anhui Province are relatively low. Even if the policy effect is good, the efficiency in recent years is still not ideal, and there is still much room for improvement.

(1) To promote rural revitalization and improve the investment and financing utilization efficiency of rural revitalization, we must promote the investment and financing subjects of Rural Revitalization to become bigger and stronger, and build a professional Rural Revitalization investment and financing platform company. ① Vigorously cultivate standardized new agricultural business entities. Vigorously implement the upgrading project of new agricultural business entities, and cultivate family farms, farmers' cooperatives and various social service organizations into qualified market-oriented business entities. Accelerate the transformation and upgrading of leading enterprises, encourage the establishment of modern enterprise system, focus on cultivating a number of demonstration enterprises leading the development of the industry, and improve the strength, investment and financing capacity of leading enterprises. ② Cultivate and expand new rural collective economic organizations with independent accounting. We will deepen the reform of the rural collective property rights system, accelerate the establishment of a new type of village level collective economic organization with clear property rights relations, sound organizational structure, standardized operation and management and independent legal person status, and clarify its organizational functions and legal person status. We will increase support for the village level collective economy and continuously enhance the village collective economic strength and investment and financing capacity. Encourage the development of mortgage loans such as production facilities and collective equity. ③ Explore the establishment of a government investment and financing platform for Rural Revitalization. Set up a special Rural Revitalization investment

company to inject high-quality government assets into the Rural Revitalization financing platform company by arranging budget funds, linking the increase and decrease of urban and rural land, non-public welfare government assets and other ways, expand the asset scale and comprehensive strength, build an integrated chain of financing, construction and operation, and enhance the credit and financing capacity of the Rural Revitalization financing platform.

(2) Financial support for agriculture is the main funding channel for the government to support agricultural and rural development. We must establish and improve the financial investment guarantee mechanism for the implementation of the Rural Revitalization Strategy, innovate the ways of financial support for agriculture, fully stimulate the driving force and vitality of social investment, and accelerate the formation of a diversified investment pattern with financial priority guarantee and active participation of social capital. ① Strengthen the priority guarantee of financial funds. We will make agriculture and rural areas a priority area for financial security and budgetary arrangements, and increase transfer payments to counties and cities (districts) with weak development foundation and limited financial resources. ② Strengthen the overall planning and integration of agriculture related funds. Promote the source integration of internal budget preparation links in the industry and the overall planning of inter industry agriculture related funds in the implementation link. ③ Make full use of land income for Rural Revitalization. Establish a mechanism for the steady growth of land income in agriculture and rural areas, and continuously increase the proportion of agricultural and rural investment. We will support poor counties and large agricultural counties to use rural land to renovate new cultivated land, link the increase or decrease of urban and rural construction land, and adjust income across regions, and support the implementation of the Rural Revitalization Strategy. ④ Give full play to the guidance and leverage of financial funds, adopt measures such as PPP, government purchase of services, establishment of funds, capital injection, financing guarantee, loan interest discount, reward instead of subsidy, private public assistance and risk compensation according to local conditions, and guide and leverage more financial and social capital to invest in agriculture and rural areas.

(3) Direct financing is not only a short board for rural areas to attract funds for development, but also the most potential source of funds for "agriculture, rural areas and farmers", We should make full use of the ways of stock financing and bond financing to revitalize the rural market. ① Explore the issuance of Rural Revitalization government bonds. Seize the opportunity of the state's strong support for government bonds and support qualified rural construction projects with certain income to issue special bonds for Rural Revitalization. Support qualified local legal person financial institutions to issue special financial bonds related to agriculture, small and micro enterprises, entrepreneurship and innovation, and carry out credit asset securitization of agriculture related, small and micro enterprises. ② Broaden the channels of multi-level capital market to support agriculture. Strengthen the construction of provincial, city and county agriculture related backup listing and listing Enterprise Library, and support high-quality agriculture related enterprises to be listed on the main board, small and medium-sized board, gem, science and innovation board or the "new third board" and provincial equity custody Trading Center for financing. ③ Accelerate the development of Rural Revitalization investment fund. Support provincial and municipal equity investment funds to set up special sub funds related to agriculture, and encourage qualified cities and counties to set up government guided Rural Revitalization investment funds. Encourage venture capital institutions and equity investment institutions to initiate the establishment of private equity investment funds to invest in agricultural industry and agricultural science and technology.

(4) Social capital is one of the main forces to promote rural revitalization. Comply with the two-way needs of industrial and commercial capital and social capital entering modern agriculture and farmers' weak capital investment, encourage and guide all kinds of social capital to invest in agriculture, form an interest complex with farmers, and realize the optimization and

integration of resource elements such as capital, technology, management and talents, so as to provide strong support for Rural Revitalization. ① Improve the policy support system. Accelerate the introduction of Anhui's implementation opinions on promoting the participation of social capital in rural revitalization, formulate corresponding fiscal, land, financial, tax and price support policies, give full play to the comprehensive effect of policies, create a legal and convenient grass-roots business environment, and further stimulate the enthusiasm of social capital to invest in agriculture and rural areas. ② Build an investment docking service platform. Drawing on the experience of Jiangsu, we will comprehensively strengthen the construction of project platforms for government services in agriculture and rural areas, such as investment promotion services, entrepreneurship incubation, property rights trading, scientific and technological support and talent gathering, so as to provide comprehensive services for social capital investment in Rural Revitalization. ③ Promote PPP mode. Actively explore the application of PPP model to projects in the field of rural revitalization, and adopt various ways such as capital injection, financial incentives, operation subsidies, investment subsidies and financing cost subsidies to attract social capital into the field of Rural Revitalization. For rural revitalization projects with different public welfare and operational degrees, various operation modes are adopted according to local conditions.

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