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Study on the influence of fiscal support to agriculture on green productivity in Anhui Province

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Abstract

"Agriculture, rural areas and farmers" is a fundamental issue related to people's livelihood. In recent years, although the agricultural industry is developing rapidly, it is followed by serious environmental pollution. How to coordinate the development of resources, environment and agricultural economy has become the most important issue in the process of China's development. Although Anhui province is a big agricultural province, since the reform and opening up, it has always adhered to the development concept of "agriculture supports industry and gives priority to the development of industry". Although the industrial development has promoted the progress of Anhui Province to a large extent, the contradictions among the three are particularly fierce. As an important means of national macro-control, finance has an important impact on the allocation of resources. Therefore, in the critical period of China's transition from traditional agriculture to modern agriculture, the financial support policy should support the green development of agriculture in an important position, and establish the corresponding policy system to actively promote the green development of agriculture.

Keywords

Fiscal support for agriculture; green TFP; Anhui; Province.

1. Introduction

Taking Anhui Province as the research object, this paper firstly measured the agricultural green total factor productivity of Anhui Province and its 16 prefecture-level cities from 2011 to 2020 by using the non-parametric analysis method of SBM-GML index method. Secondly, this paper analyzed the impact of agricultural fiscal expenditure on agricultural green TFP from theoretical and empirical levels, and explored the difficulties in improving agricultural green TFP and achieving high-quality agricultural development, and then put forward targeted policy suggestions. The research findings are: (1) There is a significant negative relationship between Anhui's financial support for agriculture and GTFP;(2) The production structure of Anhui province plays a key role in regulating the relationship between agricultural fiscal expenditure and GTFP. Put forward policy recommendations: (1) Establish and improve the financial system of agricultural green development; (2) Optimize the allocation of agricultural production factors; 3) We will strengthen innovation in agricultural science and technology; (4) Strengthen the publicity and education of ecological knowledge for agricultural practitioners.

2. Research background

Agriculture, as the primary industry in China, plays a vital role in national food security, ecological security, resource security and rural farmers' life. Agriculture develops and must develop. Due to the obvious weakness and positive externality of agriculture, it is necessary for the government to take certain financial support and financial investment to ensure the healthy development of agriculture. The financial support for agriculture in Anhui Province increased from 35.187 billion yuan in 2011 to 92.429 billion yuan in 2020. Compared with 2011, the total financial support for agriculture in 2020 increased by 162.68%; The proportion of agricultural support expenditure in the total output value of agriculture increased from 2.1% to 3.7%, and from 10.65% to 12.37%; The per capita disposable income of rural residents increased from 6,300 yuan to 16,620.2 yuan. Input in agriculture has been increased, agricultural production conditions have been improved, farmers have increased production and achieved notable results in increasing their incomes.

However, while China's agricultural development has made great achievements, it has also paid a heavy price for resources and environment. With the five development concepts put forward at the Fifth Plenary Session of the 18th CPC Central Committee, the word "green" has been paid more and more attention. This sentence clearly embodies the difficulties and hardships of green development. How to ensure green development under the premise of agricultural economic development? How to make reasonable use of the limited financial funds and improve the efficiency of financial support? These are all problems worth discussing.

3. Research status

3.1. Domestic Research

Research on the impact of fiscal agricultural expenditure on agricultural green productivity: Previous studies on the impact of fiscal expenditure on agriculture have focused on the correlation between many aspects. A large number of studies have focused on the impact of fiscal expenditure on the growth of agricultural output Yanli Lin (2014), Zhizhang Wang (2014), Lei Li (2019) et al pointed out the problems of agricultural development and farmers' income increase, etc. However, the impact of fiscal expenditure on environmental green development under the condition of agricultural fiscal expenditure is relatively ignored. With the emergence of environmental problems, research on environmental problems and agricultural productivity has also been included in the research scope of researchers. Shaodong Zhang and Yaping Wang (2007) included the impact of fiscal agricultural expenditure on the environment into the research and analysis scope of agricultural green productivity; Lingling Ren (2010), Jihong Ge (2012) and other scholars also conducted research according to different definitions and judgment methods; Rui Xiao (2018) for the first time conducted an overall study using national panel data. Then Xinxin Li (2021) conducted a specific study on a province, and Qingjiang Hu (2022) further found that there were significant spatial differences in China's fiscal expenditure on agricultural support through measurement methods. However, due to different research methods and judgment criteria, no unified conclusion was reached on the results of this study. Da Hou (2022) then took Guangdong Province as an example. The SBM-DDF model was used to measure green productivity, and the GMM model was used for empirical analysis to study the impact of fiscal agricultural support on agricultural green total factor productivity in Guangdong Province. As the basic industry of national economy, agriculture has its own important role, and the impact of fiscal agricultural expenditure on agricultural green productivity still needs further exploration and research.

3.2. Foreign Research

First, the research on the scale of fiscal agricultural expenditure. R. Ramakumar (2012) took India as an example, analyzed the changes of the scale of fiscal agricultural expenditure over the years, and affirmed the importance of the scale of fiscal agricultural expenditure in farmland irrigation, agricultural science and technology and other aspects. The second is the impact of

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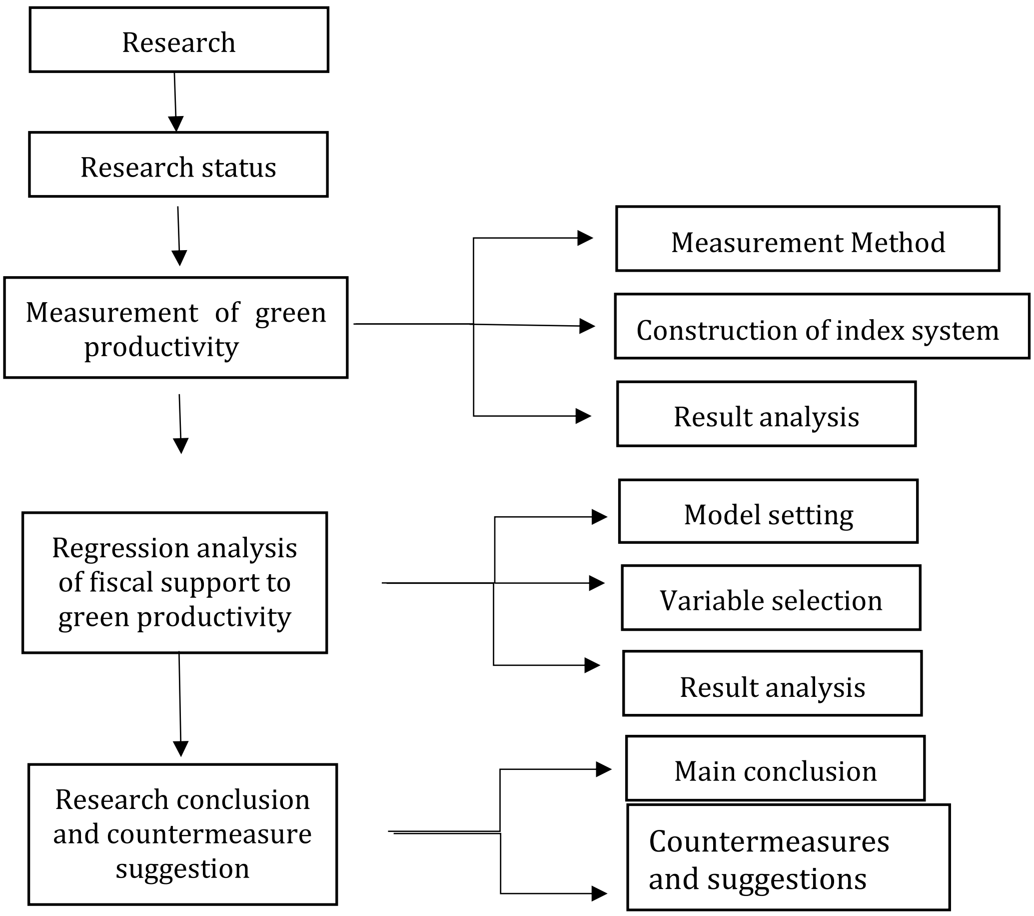
fiscal agricultural expenditure on agricultural economic growth. At present, on the relationship between fiscal agricultural expenditure and agricultural economic growth, foreign scholars have put forward different views. Jambo and Newettie (2017) found through econometric analysis that the improvement of agricultural infrastructure plays a greater role in agricultural economic growth. However, Rioja and Valev (2004) found through empirical analysis that in regions with a low level of agricultural economic development, increasing fiscal agricultural expenditure would not promote the growth of agricultural economy, but might have a negative effect on the local agricultural economy. Third, the study on the effect of fiscal agricultural support on green productivity. Pastor&Lovell (2005) extended the GML model, making the GML index model dynamically reflect the dynamic change of agricultural green productivity. It provides a useful method for the research and exploration of agricultural green productivity. Brady.et.al (2009) studied the impact of financial agricultural expenditure on ecological environment in European countries and found that the lack of targeted financial subsidies would lead to the destruction of local ecological environment.

All in all, the existing researches have made some achievements, but there are still some limitations, which are as follows: First, few people have conducted researches on rural green development from the perspective of finance; Second, although problems such as the efficiency of fiscal support for agriculture have been found, few countermeasures have been proposed based on these problems; Third, there are many national studies on green productivity, but few specific studies on a province. Based on this, the author estimated green total factor productivity from the perspective of finance, taking Anhui province as an example, and further studied the impact of fiscal support for agriculture on green economy, so as to put forward relevant countermeasures.

4. Technical route



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5. Measurement of green productivity

5.1. Measurement Method

This paper estimates agricultural green total factor productivity by including agricultural carbon emissions as non-expected output. By reading a lot of literature and referring to the measurement method of Li Kang et al., the author uses SBM-GML model to calculate.

5.2. Construction of index system

The accounting system of agricultural green total factor productivity includes input and output. Therefore, the key to measure agricultural green total factor productivity is to select appropriate input and output variables. The input index can be divided into three categories: labor force, agricultural materials and land resources. Output indicators are mainly divided into two categories: expected output and unexpected output. By reading the literature, we can find that Lu Na et al. (2019) took the number of employees in the primary industry at the end of the year, the total sown area of crops, the total power of agricultural machinery and the amount of fertilizer applied as input indicators, the total output value of agriculture, forestry, animal husbandry and fishery at constant prices as expected output indicators, and the pollution of agricultural non-point sources as non-expected output indicators. Huang Xiuquan et al. (2020) took the employment of the primary industry at the end of the year, the sown area of crops, the total power of agricultural machinery, the amount of fertilizer applied, the amount of pesticides used, the amount of agricultural film used, and the number of agricultural draft animals at the end of the year as input indicators, the total output value of agriculture, forestry, animal husbandry and fishery at the same price as the expected output indicators, and the agricultural carbon emission as the non-expected output indicators. Ma Guoqun et al. (2021) took the number of planting employees, the total sown area of crops, the total power of agricultural machinery, the effective irrigation area, the amount of pesticides used, the amount of agricultural film used, the amount of chemical fertilizer applied, and the number of large livestock as the input index, and the constant total agricultural output value as the expected output index. Agricultural carbon emission, agricultural non-point source pollution, ineffective pesticide utilization and agricultural film residue were non-expected output indicators. Therefore, on the basis of the above related studies and according to the availability of data, this paper constructs the following input-output index system:

Table 4-2 Construction of the index system

Input index	Crop sown area (thousand hectares)
	Total power of machinery (thousand kilowatts)
	Fertilizer (10,000 tons)
	Agricultural water use (billion cubic meters)
	Number of people employed in agriculture (10,000)
Indicators of expected output	Total agricultural output value (billion yuan)
Non-desired output indicator	Carbon emissions (tons)

This paper studies the agricultural green total factor productivity of Anhui Province and 16 prefecture-level cities from 2011 to 2020. The original data come from Anhui Provincial Bureau of Statistics, Anhui Statistical Yearbook, Anhui Rural Statistical Yearbook and the statistical yearbook of each city.

5.3. Regression analysis

Based on the model of SBM-GML, the following results are obtained according to the software deap2.1.

Table 4-3 Test results of green total factor productivity

year	Green total factor productivity	Green Technology Efficiency (EC)	Green Technology Advancement (TC)
2011	1.029039367	0.944114481	1.089951895
2012	1.084047794	1.066627678	1.016331955
2013	1.022528372	0.959063547	1.066173744
2014	1.102605438	1.075235451	1.025454878
2015	1.022746968	0.876709292	1.166574801
2016	1.052934403	1.003363489	1.049404741
2017	1.07939551	1.106391224	0.97560021
2018	1.041234602	0.970265157	1.073144382
2019	1.075461355	1.003866774	1.071318808
2020	1.123932687	1.001515085	1.122232409
Average	1.06339265	1.00715218	1.165409157

Table 4.3 reflects the agricultural green total factor productivity and decomposition in Anhui Province during 2011-2020. As can be seen from the table, the agricultural green TFP of Anhui province has been maintained at a level greater than 1, which indicates that the agricultural green TFP of Anhui Province has increased year by year, and the agricultural development has a sustainable green growth trend. The annual mean value of agricultural green TFP is 1.0634, which is greater than 1, indicating the continuous growth of agricultural green TFP in Hubei Province.

As can be seen from Table 4.3, in terms of the change of green technology progress, the technological progress index of Anhui Province in the sample period was greater than 1 except 2017, and the average value of the green technology progress index was 1.165, which was greater than 1, indicating the continuous growth of green technology progress; In terms of the change of green technology efficiency, except 2011, 2015 and 2018, the change index of green technology efficiency of Anhui Province was greater than 1 in other years, and the average value of green technology efficiency index was 1.007, greater than 1, indicating that the green technology efficiency was also increasing. During the whole sample period, the measured values of technological progress, technical efficiency and agricultural green total factor productivity are all greater than 1, and the three are all increasing year by year. Therefore, technological progress and technical efficiency continue to promote the continuous growth of agricultural green total factor productivity in Anhui province, mainly because of the positive impact of the strategy of "promoting agriculture through science and education". Anhui Province has invested a lot of manpower and capital in agricultural scientific research and agricultural technology development. With the continuous improvement of agricultural technology, agricultural input factors can be used more efficiently, so that the non-essential input of some agricultural materials can be reduced. Green agricultural technology can also reduce the carbon emissions caused by agricultural production process. At the same time, technical efficiency also plays a positive role, which may be the result of proper agricultural management, reasonable allocation of agricultural resources and sound agricultural system in Anhui and Hubei Province.

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6. Model construction

In order to investigate the dynamic impact of fiscal support for agriculture on agricultural green total factor productivity in Anhui province, the green total factor productivity has been measured above. On this basis, taking agricultural green TFP as the explained variable and referring to the research method of Chusheng Ye, a dynamic panel data model was built with agricultural fiscal expenditure as the explanatory variable, and GMM method was used to conduct an empirical analysis on the spatial model, so as to study the impact of fiscal agricultural support on agricultural green TFP in Guangdong Province. The model construction is as follows:

$$\boldsymbol{Y_{it} = a_0 + a_1 Y_{it-1} + \beta_1 S_{it} + \beta_2 S_{it-1} + \Sigma\varphi_j x_{j,it} + \gamma_i + \mu_t + u_{it}} \tag{1}$$

In the formula, Yit represents the agricultural green total factor productivity of region i in year t, and the data has been measured above; Y it-1 represents the agricultural green total factor productivity of region i in year t lagging one period, which is used to control the influence of lag period on the current period; Sit represents the variables of fiscal support for agriculture in region i in year t, expressed by the proportion of fiscal support expenditure in the total output value of agriculture; S it-1 represents the variable of fiscal support for agriculture in region i in year t lagging one period. Since the agricultural green total factor productivity is affected by many factors, this paper adds other control variables Xj that may affect the results. The main factors include: natural conditions X1 expressed by the proportion of the disaster-affected area in the total sown area of main crops; Agricultural production structure X2 expressed by the proportion of the sown area of food2 crops in the total sown area of crops in each region; Mechanization level X3 expressed by the proportion of the total power of agricultural3 machinery in the added value of agriculture in each region; And the level of economic development X4 is expressed by the per capita disposable income of rural residents in each region. The regression of GMM was performed by stata software. Further, in order to investigate whether the fiscal expenditure on agriculture and GTFP are affected by the agricultural production structure, the interaction terms between the fiscal expenditure on agriculture and the agricultural production structure are added to the model for regression, and the regression results are listed in II, the results are as follows:

Table 5-1 Influence of fiscal support to agriculture on green productivity in Anhui Province

Variables	I	II
	GFTP	GFTP
Sit	0.268 * * *	1.432 * *
	(5.030)	(2.371)
Sit-1	0.146 * * *	0.260 * * *
	(2.800)	(3.612)
Sit* Sit-1		2.236 * * *
		(2.825)
X1	2.013 * * *	2.786 * * *
	(2.201)	(3.387)
X2	1.736 * *	31.23 * * *
	(2.416)	(2.784)
X3	0.064 * *	0.032* * *
	(4.26)	(2.683)
X4	1.131 * *	1.325* * *
	(6.52)	(3.076)

Note: Values in brackets are statistical, with * * *, * * and * indicating significant at the 1%, 5% and 10% levels, respectively.

According to the regression result I, the regression coefficient value of fiscal support for agriculture is -0.268, which is significant at the significance level of 1%, and the regression coefficient value of the lagged item of fiscal support for agriculture is -0.146, which is also significant at the significance level of 1%. Fiscal support for agriculture inhibits the growth of GTFP to a certain extent, and there is a lag effect. The reason for this is that, on the one hand, financial support for agriculture promotes the increase of desirable output; on the other hand, financial support for agriculture stimulates the increase of input of agricultural chemicals such as fertilizers, thus promoting the increase of non-desirable output. The negative effect of the latter is greater than the positive effect of the former, so fiscal support for agriculture reduces GTFP. In terms of control variables, natural conditions X1, agricultural production structure X2 and GTFP have significant negative effects, and their correlation coefficients are -2.201 and -2.416, respectively, indicating that the greater the area affected by disasters and the larger the sown area of food crops, the lower the green total factor productivity will be. Mechanization level X3 and economic development level X4 have significant positive effects on GTFP, which indicates that the higher the rural mechanization level and the higher the economic development level, the higher the green total factor productivity will be.

According to the regression result Ⅱ, after adding the interaction item Sit*x2, the relationship between agricultural financial expenditure Sit and GTFP changed from negative to positive, and from the value of correlation coefficient, the correlation coefficient of S*x2it is -2.825, while that of AFit is 1.432. The absolute value of the coefficient of the interaction term is greater than the coefficient of the agricultural financial expenditure, which indicates that the agricultural production structure has a key moderating effect between the agricultural financial expenditure and GTFP. When the agricultural production structure conforms to the regional production mode, the agricultural financial expenditure has a significant positive impact on GTFP.

7. Main conclusions and countermeasures

Based on the above analysis, the following conclusions are drawn: (1) There is a significant negative relationship between Anhui's financial support for agriculture and GTFP. (2) The production structure of Anhui province plays a key role in regulating the relationship between agricultural fiscal expenditure and GTFP.

Based on the above conclusions, the following policy recommendations are put forward: (1) Establish and improve the financial system of agricultural green development; (2) Optimize the allocation of agricultural production factors; 3) We will strengthen innovation in agricultural science and technology. Adjust the structure of agricultural production, establish fiscal support policies related to carbon emissions, and guide and encourage farmers to use environmentally friendly technologies; (4) Strengthen the publicity and education of ecological knowledge for agricultural practitioners, transform agricultural production methods, and promote the concept of green ecological development.

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