

# *Empirical Analysis of the Effectiveness of Fiscal Agricultural Support Policies Based on Spatial Econometric Methods*

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**Abstract:** How to better evaluate the effect of agricultural support policies should take into account the interdependence and spatial correlation between regions. This study adopts spatial measurement method and combines regional panel data to conduct empirical analysis of the effect. This study first uses the spatial panel model to explore the inter-regional interdependence, and then uses the spatial lag model and spatial error model to analyse the impact of policies on farmland area, monthly income of farmers' families and the number of rural medical insurance users. The research results show that the policy has a significant positive impact on the farmland area, the monthly income of farmers' families and the number of people insured by rural medical insurance, and the implementation of the policy leads to the increase of farmland area. In general, the fiscal support policy promotes the sustainable development of rural economy by increasing the arable land area, increasing farmers' income and improving the level of rural social security.

## 1. Introduction

Promoting rural economic growth, increasing farmers' income, and improving rural social security are the goals of social development. Agricultural support policies are widely adopted as an important means to promote the development of rural areas and the well-being of farmers. However, whether the implementation effect of the policy has achieved the expected goals and how its impact mechanism between regions still requires in-depth research and evaluation. This article aims to empirically analyze the effectiveness of policies by applying spatial econometric methods. Compared with traditional econometric methods, spatial econometric methods can consider the interdependence and spatial correlation between regions, and more accurately evaluate the impact of policies. The research method presented in this article is of great significance as it can provide a deeper understanding of policy effectiveness, provide decision-making references for policymakers,

and promote rural economic development and improve the lives of farmers.

This article first introduces the background and research status of policies, and explores the shortcomings of existing research. Secondly, this article elaborates on the advantages and significance of spatial econometric methods in evaluating policy effectiveness, and explains why this method is chosen for empirical analysis. Then, this article provides a detailed introduction to the research methods adopted in this article, including data collection and processing, model setting, and variable selection. Next, this article presents and analyzes empirical results to explore the impact of policies on rural economy, farmer income, and rural social security. Finally, this article summarizes the research results, proposes policy recommendations, and discusses the limitations of this study.

## 2. Related Work

Many people have conducted research on rural development. Zhang Shuhui constructed a computable general equilibrium model to examine the impact of changes in the scale and structure of central and provincial fiscal subsidies for promoting rural revitalization on the income level and income gap of farmers. The simulation results showed that in the short term, the larger the expansion of the fund scale, the more income increment [1]. Based on provincial panel data from 2010 to 2020, He Xingxing used the entropy weight method to construct a comprehensive indicator for rural revitalization, and then used methods such as the moderating effect model and threshold model to test the relationship between fiscal support for agriculture and rural revitalization. The empirical research results showed that the development level of rural revitalization in China had obvious regional clustering [2]. Liao Xinlin's research results indicated that digital inclusive finance had a significant effect on reducing the income gap between urban and rural residents [3]. Wang Yixi found through empirical research that fiscal support had a significant promoting effect on the growth of agricultural TFP [4]. Lv Xiaolu used panel data from 2007 to 2021 and used an intrinsic linear model to study the dynamic relationship between China's fiscal support for agriculture policy and household income. The results indicated that increasing the transfer of rural labor and improving the level of agricultural development can significantly promote the growth of farmers' income [5]. Mamatzakis E found that although solvency decreased agricultural income, investment had a positive impact on agricultural income [6]. Magagula B investigated the nature of youth perception and its impact on their intention to engage in agricultural entrepreneurship [7]. Birner R found that digital agriculture was driven by private enterprises [8]. Pe'er G pointed out that meeting the needs of citizens for sustainable agriculture and correcting systemic deficiencies in the consolidated appeal process remained crucial [9]. Norton G W believed that farmer groups and virtual networks were playing an increasingly important role in technology dissemination [10]. These studies have provided great assistance for this article, which will investigate through spatial econometrics.

## 3. Method

### 3.1 Financial Support for Agriculture Policy

The government supports agricultural development and increases farmers' income through financial means [11-12], and there are many of these methods. This article focuses on discussing three policies: agricultural subsidies, agricultural insurance, and rural infrastructure construction. Agricultural subsidies are one of the direct ways in which the government provides economic support to farmers, aiming to reduce their production costs, promote agricultural development, and increase their income. The form and scope of agricultural subsidies can vary by country and region.

Table 1 shows the agricultural subsidy methods:

Table 1: Agricultural subsidy methods

Subsidy methods	Subsidy process
Land subsidies	The reduction or subsidy of land rent or usage fees provided to farmers to alleviate the pressure of land costs.
Seed subsidies	Provide subsidies for farmers to purchase seeds to encourage the use of high-quality, locally adapted seeds, and improve crop yield and quality.
Subsidies for fertilizers and pesticides	Provide subsidies to farmers for purchasing fertilizers and pesticides to reduce the cost of fertilizers and pesticides in agricultural production.
subsidies for agricultural machinery and tools	Provide subsidies for farmers to purchase agricultural machinery and equipment to promote agricultural mechanization and improve production efficiency.
Collection and storage subsidies	Provide subsidies for the purchase and storage of agricultural products to stabilize market prices and safeguard the interests of farmers.

Agricultural insurance is a financial support policy that provides risk protection for farmers through insurance mechanisms. Agricultural production is affected by risks such as natural disasters, climate change, and diseases. The goal of agricultural insurance is to help farmers reduce losses and stabilize their income. Table 2 shows the specific situation of agricultural insurance:

Table 2: Specific situation of agricultural insurance

Types of insurance	Insurance Introduction
Disaster insurance	Provide compensation to deal with the losses caused by natural disasters to crops, agricultural facilities and agricultural production.
Crop insurance	Insure against risks such as pests, diseases, wilts, and lodging of crops to protect farmers' planting input and output.
Breeding insurance	Provide insurance for the aquaculture industry to ensure the health of farmed animals and the stability of the aquaculture economy.
Income insurance	Set insurance standards based on the actual income level of farmers to ensure that farmers are compensated when their income declines.

Agricultural insurance can be provided by the government alone or in cooperation with insurance companies. The government usually provides subsidies or reduces insurance costs to encourage farmers to participate in agricultural insurance and ensure the sustainable operation of the insurance mechanism.

Rural infrastructure construction refers to the government's investment in rural infrastructure construction through financial funds to improve rural production and living conditions. These infrastructure include agricultural water conservancy facilities, rural roads, rural power grids, rural water and gas supply, etc. The goal of rural infrastructure construction is to improve agricultural production efficiency, facilitate the circulation of agricultural products, and improve the living standards of farmers [13-14]. Table 3 shows the specific situation:

Investing fiscal funds into rural infrastructure construction, providing financial support, project planning, and supervision and management. The construction and improvement of these

infrastructure can help improve agricultural production efficiency, strengthen the circulation of agricultural products, and enhance the quality of life of farmers [15-16].

Table 3: Rural infrastructure construction situation

<b>Infrastructure</b>	<b>Construction situation</b>
Farmland water conservancy facilities	Reservoirs, irrigation canals, water pump stations, etc. are used to improve farmland irrigation and drainage conditions and improve crop growth environment and yield.
Rural roads	Build and improve rural road networks, improve the convenience of transportation of agricultural products, and shorten the time and cost of agricultural products from farmland to the market.
Rural power grid	Expand the coverage of rural power grids, provide farmers with a stable power supply, and support agricultural production and rural electrification.
Rural water supply and gas supply	Improve the water supply and gas supply conditions in rural areas, solve the problems of farmers' drinking water and domestic gas use, and promote rural development.

### 3.2 Fixed Effects Model

The fixed effects model controls for unobservable differences between individuals, allowing for more accurate estimation of the impact of fiscal support policies on agriculture and farmers [17-18]. The basic form of its model is:

$$Y_{it} = \alpha + \beta X_{it} + \lambda D_{it} + \lambda_i + \varepsilon_{it} \quad (1)$$

$Y_{it}$  is a dependent variable (such as agricultural product output, farmer income, etc.),  $X_{it}$  is an explanatory variable (such as an indicator of fiscal support for agriculture policy), and  $D_{it}$  is a time dummy variable (used to capture changes over time),  $\lambda_i$  is the individual fixed effect (used to control for unobservable differences between individuals), and  $\varepsilon_{it}$  is the error term. The coefficient  $\beta$  in the model represents the impact of fiscal support for agriculture policies on dependent variables. If  $\beta$  is significant and positive, it indicates that the fiscal support for agriculture policy has a positive impact on the dependent variable; if  $\beta$  is significant and negative, it indicates that the fiscal support for agriculture policy has a negative impact on the dependent variable. The fixed effects model controls unobservable differences between individuals through individual fixed effects  $\lambda_i$ . This means that the model compares the changes of the same individual at different time points, rather than the differences between different individuals. This can reduce the impact of individual heterogeneity on the estimation results.

### 3.3 Selection and Theoretical Basis of Spatial Econometric Methods

The reason for choosing spatial econometric methods is that they can help consider the interdependence and spatial spillover effects in geographic space, as there may be spatial correlations between farmers in rural areas and agricultural output [19-20]. The agricultural production levels in adjacent areas may affect each other, or farmers may share resources or information. So we consider spatial dependence in order to fully understand the effectiveness of fiscal support for agriculture policies. The implementation of fiscal agricultural support policies in a

certain region may have spillover effects on neighboring areas. Agricultural subsidy policies in a region may increase the production of agricultural products in that region, but may also encourage farmers in neighboring areas to increase input and improve production. Spatial econometric methods can help us capture this spillover effect. The spatial lag model assumes that the dependent variables of a region are influenced by the dependent variables of that region and its neighboring regions. This method is based on spatial autoregression theory, which assumes that the agricultural output or farmer income of a region is influenced by the output or farmer income of neighboring regions.

#### 4. Results and Discussion

This article uses spatial econometric analysis to analyze the effectiveness. This study selected village A as the experimental object and implemented support policies on it, while selecting village B adjacent to village A as the control object. Village B did not implement a policy to support agriculture. The evaluation indicators for the experiment were farmland area, monthly income of farmers, and the number of rural medical insurance beneficiaries. The experimental period was two years, during which indicator data was collected from the two villages.

##### 4.1 Farmland Area

The area directly affecting the total output and supply capacity of products. One of the goals of the fiscal support for agriculture policy is to improve the level of production. By expanding the farmland area, the planting area of crops can be increased, thereby increasing the yield of products. Figure 1 shows a comparison of farmland area:

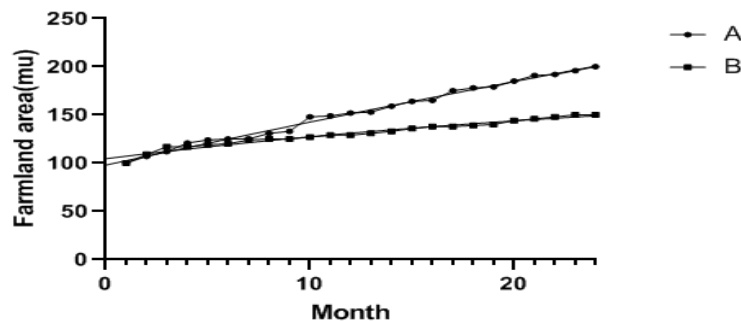


Figure 1: Farmland area

In the past two years of testing, the initial area of both village A and village B was 100 acres. After two years of support policies, village A's farmland area reached 200 acres, while village B's farmland area increased to 150 acres after two years without support policies. The support policy has increased the farmland area of village A by 50 acres compared to village B, indicating that the support policy has played a certain role in village A, at least in improving the farmland area.

##### 4.2 Monthly Income of Rural Households

Evaluating the impact of fiscal support for agriculture policies on the monthly income of farmers can directly reflect the improvement effect of policies on their living standards. The increase in monthly income of rural households means an increase in their economic benefits, which can improve their quality of life and enhance their basic living standards. Figure 2 shows the comparison results between village A and village B:

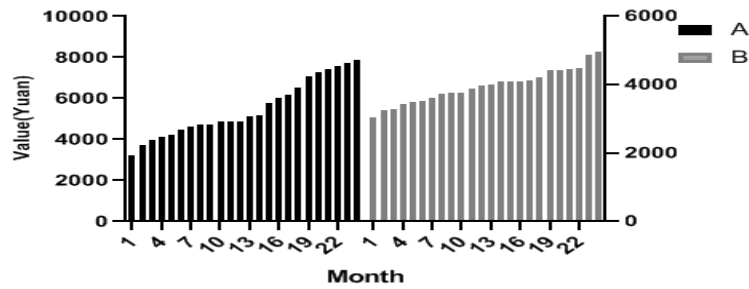


Figure 2: Family monthly income

At the beginning, both villages had a monthly household income of around 3000 yuan. Due to the support of policies, village A's monthly household income increased from around 3000 yuan to around 8000 yuan, while village B increased to around 5000 yuan. Village B did not receive support from policies, but it also increased monthly household income. This is the result of the country's strong economic development. However, through policies, village A's monthly household income is 3000 higher than village B.

#### 4.3 Number of Insured Persons in Rural Medical Insurance

The number of insured persons in rural medical insurance can reflect the coverage and popularity of fiscal support for agriculture policies. The increase in the number of insured individuals means that more farmers can enjoy the benefits of medical insurance, thereby improving their social security level. Figure 3 shows the changes in the number of insured persons in A B two villages:

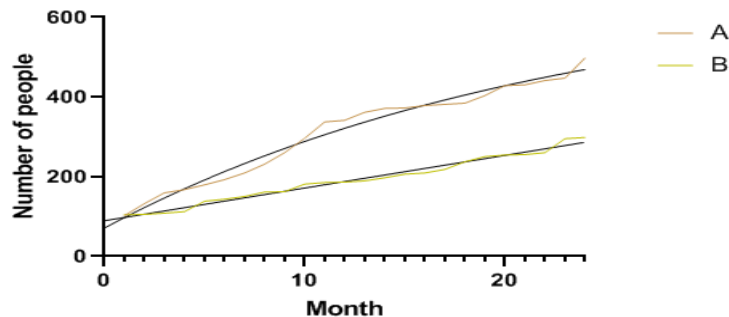


Figure 3: Number of insured persons in medical insurance

In the survey of the number of insured persons in medical insurance, the difference in the number of insured persons between the two villages before the testing was not significant, both around 100 people. With the intervention of support policies in village A, the number of insured individuals increased to 500 within two years, while in village B, without policy assistance, the number of insured individuals only increased to 300 within two years. This indicates that the support policy has had a good effect.

## 5. Conclusion

Empirical analysis shows that this policy has achieved positive effects in promoting rural economic development, increasing farmer income, and improving rural social security. The research results show that the fiscal support for agriculture policy has a significant positive impact on the increase of farmland area and the improvement of monthly income of farmers. The expansion of farmland area provides more opportunities for production, improves product yield and farmers'



income level. At the same time, the increase in the number of insured persons in rural medical insurance has also reduced the medical burden on farmers and improved the level of medical security. In addition, the application of spatial econometric methods reveals the impact of inter regional interdependence on the effectiveness of fiscal policies, that is, the promotion and impact of policies in adjacent areas have spillover effects, further promoting the development of rural economy. Overall, the fiscal support for agriculture policy has promoted the sustainable development of rural economy, improved the living standards and well-being of farmers by increasing farmland area, increasing farmers' income, and improving rural social security levels. However, further in-depth research and improvement of policy measures are needed to address existing problems and challenges, ensuring the long-term sustainability and comprehensive benefits of fiscal support for agriculture policies.

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