

# A Summary of Studies on Jiangsu Agricultural Growth Driven Heterogeneity Research

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**Abstract**—Agriculture is a basic industry for the development of China's national economy and a guarantee for the development of its entire national economy. The issue of agriculture and rural areas has always been a fundamental issue concerning the national economy and the people's livelihood. Those who are diligent in politics, who are raising their own people and those who are good at governing the country, must first enrich the people. For China, where the farmers are the majority, the relationship is even more symbiotic.

**Keywords**—Heterogeneity; agriculture; DEA; efficiency

## I. INTRODUCTION

General Secretary Xi Jinping first proposed the "Village Revitalization Strategy" in the report of the 19th National Congress. In 2018, the Central No. 1 Document clearly pointed out that the goal of rural revitalization is to achieve "prosperous industry, ecological livability, civilized civilization, effective governance, rich life." Among them, "prosperous industry" is the premise basis for living rich, ecologically livable, rural civilization and effective governance, and its core supporting force is to greatly improve the efficiency of agricultural production in China. From "production development" to "prosperous industry", the agricultural and rural economy is required to develop more comprehensively. The development of agricultural economy has long been the focus of attention of Chinese government and scholars, and it is a major issue facing China's economic and social development. Studying the issue of agricultural economic growth plays an extremely important role in improving the input-output structure of agriculture, improving the comprehensive competitiveness of the agricultural industry, implementing the strategy of revitalizing the countryside, and achieving the goal of "two hundred years" in the new century.

As a major economic province in China, Jiangsu Province has achieved new results in the development of agricultural and rural economy. At the high starting point, it has achieved steady growth, steady improvement, and steady progress. First, the production of major agricultural products and the income of farmers have increased steadily. The total grain output for the year reached 35 billion kilograms. The grain yield was 432.9 kilograms, ranking first in the rice and wheat double-crop area in the country, and it was stable at

more than 400 kilograms for nine consecutive years. The newly built "vegetable basket" engineering vegetable base was 14,533 hectare, and the total vegetable output increased by 5%. The production of pigs was generally stable, the production of poultry was gradually restored, and the output of meat and milk increased slightly year-on-year. The per capita disposable income of rural residents has reached a level of 15,000 yuan, an increase of about 10.5%, and the growth rate has been higher than that of urban residents for five consecutive years. Second, modern agricultural construction has achieved steady improvement. The number of national modern agricultural demonstration zones, performance evaluation, agricultural reform and pilot assessment are the three "national firsts". Third, the promotion of high-tech applications has progressed steadily, with high-efficiency facilities accounting for 16.5%, agricultural science and technology contribution rate exceeding 64%, and 13 national agricultural industrialization demonstration bases, ranking first in the country. However, we should also clearly understand that in recent years, due to the advancement of urbanization, the cultivated land has been decreasing year by year. The quality of cultivated land is deteriorating, the resistance of land to pesticides and fertilizers is enhanced, and the phenomenon of "hollowing" in rural areas is serious. This poses a great challenge to the stable yield and high yield of agricultural land and the sustainable development of agricultural economy.

This article is based on the importance of national agriculture, with Jiangsu Province as an important sample, in-depth study of its agricultural economic growth sources. The source of agricultural economic growth is an important direction for theoretical research on agriculture and an important reference indicator for the government to examine the agricultural economy. Therefore, many scholars and institutions have conducted in-depth research on agricultural growth-driven research as an important topic in the study of agricultural regional economics. Compared with the provincial-level regions, the cities and counties are more direct carriers of the rural economy and society, and are closer to the actual agricultural production. Scientifically measuring the driving factors of agricultural economic growth in the county and the different mechanisms of action in Jiangsu Province will help to further identify the agricultural growth in Jiangsu. The source and growth model are conducive to judging the growth quality of Jiangsu

agriculture from the county perspective, exploring the county agricultural growth model in line with Jiangsu Province during the transition period, optimizing the agricultural economic structure and realizing the coordinated development of urban and rural economy, and providing the theory for agricultural development in Jiangsu Province.

## II. RESEARCH CONTENT

Firstly, the design of agricultural production evaluation mechanism in Jiangsu Province needs to consider the economic benefits brought by agricultural development in Jiangsu Province on the one hand, and the ecological production damage caused by the necessary production materials such as chemical fertilizers for agricultural production development. When evaluating the efficiency of agricultural production, the economic and ecological benefits of agricultural production are taken into account, which is different from the economic benefits brought about by considering only agricultural production in the study of agricultural production.

Secondly, using the Manquist productivity index combined with the index to empirically analyze the static and dynamic changes of agricultural production efficiency in Jiangsu Province and other provinces in China. Calculate the horizontal (spatial distribution pattern) of agricultural production efficiency in Jiangsu Province and other provinces and cities with the provinces and municipalities directly under the Central Government, and calculate the vertical (temporal evolution model) of Jiangsu Province in each year. Efficiency, and find its source of economic growth by breaking it down into two parts: technological progress and technical efficiency.

Thirdly, based on the above analysis, the time-space weighted regression analysis model is used to empirically analyze the influencing factors of agricultural economic development in Jiangsu Province, and reveals the main factors affecting its agricultural economic growth and different mechanisms of action.

Fourthly, propose the policies or suggestions for Jiangsu Province to benefit its agricultural economic development. The best agricultural development strategy needs to combine theoretical analysis with the actual situation of each place. This combination often leads to inevitable contradictions, which is also more challenging in this paper.

## III. AGRICULTURAL ECONOMIC GROWTH INVESTMENT ANGLE

The factors influencing the growth of agricultural economy can be divided into three categories:

The first is the physical input. The input factors selected in the study of agricultural growth are: land, labor, capital, fertilizer and electricity. Li Jing and Meng Lingjie (2006) in the empirical study based on the non-parametric HMB productivity index, select the number of labor in the primary industry, the total power of agricultural machinery, the effective irrigation area, the amount of chemical fertilizer applied, the area planted with crops and the number of large

livestock are input indicators. While Liu Linhai (2008) used DEA to analyze the agricultural production efficiency in Jiangxi and surrounding areas, due to the reliability of data sources, only the planting area, fertilizer application rate, rural electricity consumption, total agricultural machinery power and livestock number were selected. Huang Lijun, Hu Tongyang (2009) used DEA to analyze the agricultural production efficiency in western China. The input indicators selected include: fertilizer application rate, planting area, number of employees in the primary industry, rural electricity consumption, animal husbandry power and total power of agricultural machinery; Wang Yakun Wang Huijun and Jiang Bing (2014) based on the analysis of agricultural total factor productivity in Hebei Province in the Malmquist index method, further subdividing the physical inputs, selecting the planting area, total agricultural machinery power, agricultural fertilizer application, agricultural film use, and agricultural use. Diesel usage and pesticide use; Huang Ansheng, Xu Jiaxian Zheng Jing and Liu Zhenbin (2014) The empirical analysis of agricultural total factor productivity in the main grain producing areas under the national scope will be portrayed as the total area planted with crops, the total power of agricultural machinery, the amount of agricultural fertilizers, the effective irrigation area, agriculture, forestry, animal husbandry and fishery. The number of employees in the industry; Li Xuesong (2015) selects the employees of agriculture, forestry, animal husbandry and fishery, the total area of crops planted, the total power of agricultural machinery, the amount of agricultural fertilizers, and the input of livestock and livestock to large livestock in various regions

The second is the technical variable. Huang and Rozelle (1996) used the data of the 13 major grain producing areas in China from 1975 to 1990 to select the generalized Leontief profit function model for estimation. The empirical results found that all the factors leading to the increase of rice production in the technological change. 60% of Fan; (1997) empirical results show that between 1965 and 1993, the contribution of scientific research to China's agricultural growth was 19.5%; Xu (1999) also showed the total factor productivity of Chinese agriculture between 1979 and 1996 (Total Factor Productivity (TFP) increased by 47%. Kaneko used the provincial panel data of 1999-2002 to carry out the technical efficiency of agricultural production in various regions of China. Through research, it was found that technological progress and opening up to promote agricultural production technology in eastern China. Zhou Hong and Yan Baojin (2010) compared the contribution of productivity to economic growth from the comparison with Western countries. They pointed out that the promotion of production efficiency led by science and technology is the focus of China's agricultural economic development. Other scholars such as Li Jing, Meng Lingjie (2006), Li Gucheng, Feng Zhongchao, Fan Lixia (2007) and others have also given similar conclusions, that is, technological progress is an important input factor for agricultural growth in most parts of China.

The third is institutional variables, and the reform of the system is closely related to China's agricultural growth. Lin

Yifu's point of view is that farmers are easy to slack off and the cost of supervision is high. The people's communes in the planned economy are inefficient. The empirical results of Lin (1992) indicate the contribution rate of the household contract responsibility system to agricultural growth in 1979-1984. 46.89%; Fan and Pardy (1997) showed that from 1978 to 1984, the contribution of institutional reform to China's agricultural growth was 38.6%, and this value became 42.1% in 1985-1993, indicating that China's agricultural growth, the institutional reform in 1985-1993 was 3.5% higher than that in 1978-1984; Huang Shaoan et al. (2005) conducted an empirical analysis of the agricultural production efficiency in mainland China from 1949 to 1978. Cooperative or moderately unified management is a relatively good system, which can stimulate the input of various production factors to a large extent, which will make the total agricultural output value increase at a high speed and steady; Chaucer et al. (2006) use the CD production function to 1978. - An empirical analysis of China's agricultural growth in 2004, the results show that in 1978-1984, the contribution of household contract responsibility system to agricultural growth 21.2%, the price changes, tax reforms and financial support introduced in agricultural production and management in 1989-1995 to influence the enthusiasm of people engaged in agricultural production and management, that is, the decisiveness of agricultural growth after China's reform and opening up Institutional changes in factors are very important; in addition, Xi Liqing and Peng Kemao (2010), Sheng Jichuan et al (2010) scholars through analysis that institutional changes after the reform and opening up have an intrinsic decisive influence and promotion on China's agricultural economic growth.

#### IV. AGRICULTURAL ECONOMIC GROWTH DRIVING ANGLE

##### A. Factor Input Drive

Fan and Pardy (1997) estimated the model of agricultural development in China in different periods. The physical input variables in the empirical equation include labor, land, fertilizer and electricity. The empirical results show that the fertilizer has the largest contribution in physical input, from 1965 to 1993, 21.7% of China's agricultural growth was due to the input of fertilizers. The contribution rate of electricity input was 12.9%, the contribution rate of labor force was 7.5%, and the contribution rate of land was very small. Echevarria applied the Solow production function tool to study the provincial agricultural production data of Canada from 1971 to 1991. The results show that in 20 years, the contribution of labor to agricultural production is 0.4138, and the contribution of land to agricultural production is 0.1597. The contribution of agricultural production is 0.4265, and the contribution of the three factors to agricultural output is very different between different provinces. Hu and McAleer used the Cobb-Douglas production function to estimate the agricultural production efficiency of China's 30 provinces from 1991 to 1997. The results show that the mechanical output elasticity is -0.1976, the labor output elasticity is 0.2347, and the land production. The elasticity is -0.1347, and the yield elasticity of fertilizer is 0.5290. Xin Xiangfei

and Qin Fu (2008) selected the panel data of labor, material costs and land in 30 provinces of China from 1988 to 2003, and analyzed the impact of these three factors on the elasticity of agricultural output. The structure shows that the output elasticity of labor resources is 0.1066, the output elasticity of material costs is 0.4890, and the output elasticity of land is 0.2659. In addition, Lio and Liu, Lin Yurui (2007), Kong Chaoli, Yang Qichang (2006), Li Guozhen, Zhou Qi (2007) also measured the contribution of land, livestock, fertilizer, labor and other factors to agricultural economic growth by different methods.

##### B. Technological Advancement Drive

Vicente (2004) used the non-parametric frontier model method to study the agricultural production efficiency of Brazil in the year. The results show that the agricultural sector is inefficient and inefficient, and if it is technically fully efficient, it will increase the agricultural output value by more than 30%; Luo Gangping, Zhu Zhiyong (2009) analyzed the changes in agricultural production efficiency in 40 districts and counties in Chongqing from 2000 to 2006, and proposed to pay attention to the role of technological progress, and gradually reform and improve the current agricultural technology extension system; 2009) Using panel data from 1978 to 2007, using the model established by the SFA-based Manquis index, the agricultural TFP change index of each province in China was examined. The results show that China's agricultural TFP growth is mainly attributed to the development of agricultural science and technology. This result is close to the conclusions of Jiang Yuyu (2005) and others, showing obvious stage and regional imbalances.

##### C. Financial Expenditure Driven

Wen Tao and Wang Yuyu (2005) selected China's 1952-2002 actual data for unit root test, co-integration test, causality test and variance decomposition. The empirical analysis shows that the increase of China's fiscal support for agriculture inhibits the growth of agricultural economy. The elasticity coefficients are -2.68 and -5.43, respectively; and the growth of agricultural loans does not promote agricultural economic growth. Wei Lang (2006) used the Cobb-Douglas production function to empirically analyze the panel data of agricultural economic growth in six provinces and autonomous regions in the west of 1999-2003. The study found that the contribution rate of local fiscal support to agricultural economic growth is on average. It is 18.04%, and its output elasticity coefficient is 0.06; Liu Han (2008) uses the data of China's 1980-2006 to select the CD production function model to quantitatively study the relationship between the total amount of financial support for agriculture and its composition and agricultural output. The fiscal support for agriculture has a significant positive impact on agricultural output growth; Cai Zhongyan (2010) used the inter-provincial panel data from 1997 to 2006 to quantitatively analyze the relationship between fiscal decentralization, fiscal agricultural expenditure and agricultural economic growth, and found that Chinese agriculture Economic growth is the impact of fiscal decentralization through fiscal agricultural expenditures; Bai

Xiaoyan and Li Feng (2005) analyze the relationship between agricultural policy finance and agricultural economic growth in China; Wang Dan and Zhang Wei (2006) find that rural financial development leads to changes in agricultural economic growth, but the short-term effect is not obvious; Cao Xiehe (2008) found that China's agricultural loans to agriculture since 1978. The role of economic growth and the increase of farmers' income is not obvious, and the loan of township enterprises has a significant positive effect on agricultural economic growth; Lu Meijuan et al. (2010) examined the agricultural production and related financial support factors of 13 cities in Jiangsu Province in 1996-2005. The relationship between the financial support and the growth rate of financial support is an important factor; Qi Huiru (2010) uses the data of 31 provinces, autonomous regions and municipalities of China from 1978 to 2007, using dynamic panel data model for empirical analysis, and the results show that China's agricultural deposits and loans. The elastic coefficient for agricultural economic growth is 0.04 and 0.04, which is weak, which is consistent with the conclusions of Wen Tao and Wang Yuyu (2005).

#### *D. Export Trade Driven*

Chen Longjiang et al. (2005) found that the total contribution of China's agricultural products to agricultural economic growth during the period from 1982 to 2003 averaged 8.19%. In the recent years after China's accession to the WTO, the contribution of agricultural products to agricultural economic growth has become more and more important; Du Hongmei And Anlong (2007) found that agricultural exports have a greater role in promoting the growth of China's agricultural economy in the short term, while agricultural imports have a greater role in promoting agricultural economic growth in the long run; Liu Wei (2010) argues that the impact of foreign trade on agricultural growth is not significant;

#### *E. Structural Adjustment Drive*

Li Guanghui and Wang Qingfeng (2007) used Shandong Province as an example to analyze the relationship between agricultural restructuring and agricultural economic growth. The research shows that there is a long-term stable relationship between agricultural structural adjustment and agricultural economic growth, and mutual cause and effect; Liu Chenghong and Zhang Bing (2009) quantitatively analyzed the impact of agricultural internal structure changes in different regions of China on agricultural economic growth. The research of Shao Yishan, Li Yuxin (2009), Li Yunlong (2011) and Li Aina (2017) also proved the above conclusions.

#### *F. Human Education Drive*

Song Huaming and Wang Rong (2004) calculated the contribution of higher education to the growth rate of agricultural economy in China from 1990 to 2000, and believed that the contribution of higher education to the growth rate of agricultural economy was very low; Sun Jingshui and Dong Yajuan (2006) used China from 1997 to

2004. The statistics of 30 provinces, autonomous regions and municipalities use the fixed effect method to estimate the Lucas human capital model. The empirical results show that rural human capital has a significant positive impact on agricultural economic growth, and the elasticity coefficient is 0.345, but the educational level at all levels is agricultural economic growth. The impact of junior high school education on agricultural economic growth is 0.315, which is the most important source of human capital; Yin Zongcheng and Wu Yonghui (2009) use the statistical data of Anhui Province from 1995 to 2006, using VAR model and Empirical analysis of impulse response, etc., found that rural compulsory education investment has promoted agricultural economic growth after three phases; Du Jiang and Liu Wei (2010) used 1980-2007 time series data for empirical research, and the results showed that human capital investment. It is an important part of the household's living expenses, and farmers will always teach. Education investment is in the first place and more and more attention is paid to the investment in migration. Xiao Xiaoyong et al. empirically analyze the technical efficiency of agricultural production in China from 1999 to 2009, focusing on the education level and health level of rural areas. The impact of efficiency, the research results show that the technical efficiency of agricultural production will be greatly improved with the education level and health level of farmers, and with the passage of time, the effect of education on the efficiency of agricultural production technology is more significant.

#### V. AGRICULTURAL ECONOMIC GROWTH MEASURE

One is the study of agricultural production efficiency based on macro data at the national level. For example, Fang Hong (2010) based on DEA agricultural production technology efficiency model, using China's 1988-2005 panel data to empirically analyze China's agricultural production technology and its influencing factors, research shows that, overall, China's agricultural production technology efficiency is still certain. The space for improvement, and the efficiency of agricultural production technology between the east and the west have obvious gradient effects. The difference in the efficiency of agricultural production technology between the central and western regions has gradually expanded. Strengthening the skills training for rural labor and improving their education level is improving the main way of agricultural technology efficiency in China. In addition, some other scholars have used different methods to study the technical efficiency of agricultural production in China in different periods. For example, Wu Yuming (2010) used the spatial econometric model to study the technical efficiency of agricultural production in China, Guo Junhua et al. (2010), Zhou Di et al. (2012). The three-stage DEA model was used to study the technical efficiency of agricultural production in China in different periods. Meng Lingjie (2000) and Han Xiaoyan (2005) adopted the DEA model for agricultural production efficiency in China from 1980 to 1995 and 1981-2002 respectively. In-depth research was conducted.

The other category is based on provincial-level data to study the technical efficiency of agricultural production in various regions. For example, Zhou Yaohua (2009) used the Manquist full-factor production efficiency index decomposition method to study the agricultural production efficiency in various regions of Liaoning Province, and found that technological progress is the main reason for promoting the increase of Liaoning's agricultural total factor productivity. The investment can greatly improve the efficiency of all-factory agricultural production in Liaoning Province. Zhang Yuwen (2010) used the DEA model to evaluate the agricultural production efficiency of the 204 national road sample zone in Jiangsu Province, and selected some years for key analysis. The study found that during the sample period, the agricultural production technology efficiency showed a "U-shaped" discovery situation, namely 1980. Before the year, the agricultural production efficiency showed a downward trend, and then showed a gradual improvement trend. At the same time, the comparative study on the national agricultural development policies during the research period has a high research reference value. Other scholars such as Liu Li (2012), Jin Huaiyu (2011) and Qian Li (2010) used the DEA model to conduct empirical research on the agricultural production efficiency of Anhui Province in different periods. Jiao Junfang et al. (2006) studied the agricultural production efficiency in central China since 1978. Xu Qing (2014) and Jin Jian (2010) studied the technical efficiency of agricultural production in Shandong Province and Hebei Province respectively.

There is also research on the county and city level. Song Tingshan (2012) pointed out that during the "Eleventh Five-Year Plan" period, most agricultural production in Shandong Province is more effective, and Qingdao City and Heze City need to further reduce the scale of agricultural production and improve agricultural production technology. The level of agricultural production and production technology should be improved in Rizhao City and Liaocheng City; Sun Xiaoxin (2015) and other scholars used the DEA-BCC model to measure the agricultural production of 20 prefecture-level cities in Huaihai Economic Zone from 2002 to 2012, pointing out the research. The overall efficiency of agriculture in the region is generally low, and the pattern of agricultural development level in the east and west is still unchanged. The agricultural production technology level restricts the main factors of agricultural production in the study area. Yan Shuxia (2015) and other scholars based on the gray DEA model, measured the agricultural production efficiency of 18 cities in Henan Province from 2003 to 2008. The results show that after eliminating the impact of impact disturbance factors on agricultural production efficiency, the measurement of agricultural production efficiency is more to be reasonable and precise. Hu Qitu (2015) and other scholars used the DEA model method to calculate the agricultural production efficiency of various Inner Mongolia cities. It pointed out that Inner Mongolia's agricultural production efficiency is generally good, but only four leagues have achieved full effectiveness of DEA, and other alliances still have room for improvement; the regional concentration of agricultural production efficiency is not obvious. Chen Xiaoling (2011), Chen Fangyi (2015), Zhang Xuesong

(2015), Yu Wei, Meng Zhixing (2018) respectively studied the county-level cities of Fujian, Jilin, Heilongjiang and Shanxi with the DEA model, and put forward targeted opinions and suggestions.

## VI. CONCLUSION

The main ways to promote agricultural economic growth are: factor input growth and productivity growth. After sorting out and analyzing the literature, it is found that scholars have a wide range of research and deeper research. From an empirical perspective, many scholars have studied the impact of financial support, foreign trade, institutional change, rural finance, industrial structure, and human capital on agriculture. The data used includes cross-sectional data, time series data, or panel data combining a section and a time series. In terms of research content and methods, the unit root, co-integration and Granger causality test are used to analyze the relationship between agricultural economic growth and influencing factors. Compared with agricultural developed countries, China's agriculture is still in an extensive stage, and there is a huge gap in the growth of agricultural economic growth. The speed of agricultural economic growth can neither meet the farmers' own production needs nor meet the domestic huge consumption of agricultural products demand. The research on agricultural economic growth has always been a research hotspot of scholars at home and abroad, and the research focus is basically on the evaluation of agricultural production efficiency.

In view of the fact that there are few studies on the utilization of agricultural resources and the development of agricultural industry in Jiangsu Province, this paper combines the theoretical study of agricultural production efficiency, using the Mannquist productivity index based on the combination of DEA and index for agriculture in Jiangsu Province and other provinces in China. The empirical analysis of production efficiency is compared with static and dynamic changes. Combined with the relevant content of geoeconomics, the econometric model is used to analyze the factors affecting the efficiency of agricultural production in Jiangsu Province, and analyze them one by one.

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