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RESEARCH ARTICLE

Productivity Growth in China's Agriculture During 1985-2010

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Abstract

This paper made an empirical analysis of China's agricultural growth path and influential factors using the province-level panel data of agricultural inputs and outputs during 1985-2010. The findings indicate that the increase in agricultural inputs and TFP contributed 40.6 and 55.2% to the agricultural output growth, respectively; China's agriculture had jumped out of the pattern which output growth was mainly driven by increasing input. Of the total inputs, chemical fertilizer had the most important contribution to the output growth, followed by mechanical inputs. The contribution of land and labor was negative. China's agricultural output growth belonged to the type of induced technology innovation. China's agricultural TFP growth had characteristics of fluctuations over time and unbalanced between regions, but the gap between the eastern, the middle, and the western regions has been narrowed.

Key words: agricultural output growth, input, total factor productivity (TFP)

INTRODUCTION

The issue that how China's agriculture can be ensured to have a sustained and healthy growth has been a concern of the policymakers and scholars. China's rural reform, beginning in the late 1970s, has not only solved the problem of food shortages plaguing China, but also had a profound influence on the reform of the country's economic system. However, with the acceleration of industrialization and urbanization, agricultural resources are continuingly flowing to non-agricultural industries; the pressure to maintain the growth in agriculture is increasing, and the whole society has an increasing concern for the ability to retain the agriculture stable growth. It has been widely accepted that the extensive mode of growth has become the major obstacle to the sustainable, healthy and steady development of China's agriculture, and it is imperative to transform the mode of agricultural growth. The meaning of the mode transformation of agricultural growth is shifting the source of agricultural growth from the inputs to the increase in TFP growth. Therefore, the accurate evaluation of the trend of the contribution rate of TFP to the agricultural growth has an extremely practical significance for the agricultural development strategy in the future.

It is generally recognized that China's agricultural output growth comes from the input increase, technological progress and institutional innovation, while the contribution of institutional innovation is made mainly in the early stage of rural reform. The study by Lin (1992) shows that about 40% of agricultural out-

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put growth during 1980-1984 are contributed by the household responsibility system reform. This conclusion is supported by other researches (e.g., Mcmillan and Zhu 1989; Wen 1993; Fan and Zhang 2002). The outstanding contribution of the household responsibility system to the agricultural growth is fully released with the reform widely spread since 1984. Afterwards, agriculture enters a normal growth stage in which it is more sensitive to the prices and factor inputs. That is, technological progress has become the major factor to promote the agricultural output growth after the household responsibility system reform spread nationally (Huang and Rozelle 1996; Fan and Pardey 1997; Mao and Koo 1997; Jin *et al*. 2002). Nevertheless, scholars did not reach an agreement on this judgment. By analyzing the change in the rural land systems and price, financial and taxation systems and its influences on the agricultural growth during 1978-2004, Qiao *et al*. (2006) reach the conclusion that institutional change is still the decisive factor of agricultural output growth after rural reform. That is, after the full release of the effect of the household responsibility system reform, the following innovations in agriculture institutions continue playing a huge role in agricultural output growth. Some research shows agricultural output growth still relies on the inputs since the rural reform, but TFP contribution gradually increases. The research conclusion of Xu (1999) is that TFP has a contribution rate of 47% to agricultural output growth from 1979 to 1996. The research conclusion of Zhou (2009) is that TFP has a contribution rate of 51.24% to agricultural output growth during 1978 to 2005. Based on the revised data of inputs and outputs, Zhao and Cheng (2011) reach the conclusion that the contribution of TFP growth has exceeded the contribution of the output growth of the comprehensive inputs since 2001.

During 1996-2003, China's agricultural output growth was staying in a depressed stage. From 2004 to present, the situation of agricultural output growth is obviously improved and the grain production has continuously increased.

Using the provincial data of agricultural inputs and outputs during 1985-2010, this paper analyzes the paths and the factors affecting China's agricultural output growth by phases, expecting the research results being able to provide a support to the long-term policies of China's agricultural development.

The rest of this paper is organized as follows. Section 2 introduces methods, model selection and data processing. Section 3 analyses the sources of agricultural growth. We analyses agricultural TFP growth in section 4. Finally, we conclude.

METHODS, MODEL SELECTION AND DATA PROCESSING

Theoretically, the direct sources of agricultural growth are comprised of two parts, additional inputs and the increase in the factor productivity. As the input-output efficiency reflected by single-factor productivity is easily misleading, researchers generally use TFP to measure the efficiency of agricultural output. Solow incorporates technological progress into the production function and establishes a measurable growth model, which makes it become possible for people to conduct the quantitative analysis on the relationships between the output growth, TFP, and various input factors. According to the Solow growth model, TFP is calculated by subtracting the growth contributions of all inputs from the output growth, which is also called "Solow residual" theory. Besides the contribution of new technology, there are also the effects of factors such as institution, weather, and others in the residual value.

In order to analyze the role of all factors in agricultural growth, in this paper, the production function is established based on the method proposed by Griliches (1963), and the Log-linear form of the Cobb-Douglas function is selected. The corresponding econometric model is:

$$\ln Y=\text{constant}+\alpha_1\ln land+\alpha_2\ln labor+\alpha_3\ln fert+\alpha_4\ln power+\alpha_i T_i+\varepsilon$$

Where, Y denotes the total agricultural output level; *land*, *labor*, *fert*, and *power* represent the amounts of land, labor, fertilizer, and mechanical inputs, respectively; constant is Solow residual; T_i is time trend and ε is random disturbance of the model.

This paper mainly investigated the long-term path of China's agricultural growth, and it is believed that the contribution of the household contract