Chapter 101
Evaluation of Agricultural Modernization Based on Maximizing Deviation and GMDH

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Abstract The level of agricultural modernization is an important indicator to measure agricultural development. China, a big agricultural country, always needs to pay attention to the development level in the process of promoting agricultural modernization. This paper makes an empirical analysis of the process of agricultural modernization in Sichuan Province in recent sixteen years to put forward a new way to evaluate the level of agricultural modernization. At first, the maximizing deviation is used to evaluate the level of agricultural modernization, and then GMDH method is applied to determine the contribution value of the factors affecting the process of agricultural modernization. The results show that the level of agricultural modernization in Sichuan is gradually increasing. This paper also indicates that it is quite important to speed up the transfer of rural labor force and improve their cultural quality, raise the level of agricultural mechanization, increase the forest coverage as well as reduce the agricultural disasters. Only in this way can we realize agricultural modernization eventually.

Keywords Maximizing deviation · GMDH · Comprehensive evaluation · Agricultural modernization

101.1 Introduction

The agricultural modernization in China is mainly a process that turns the traditional agriculture into a scientific, technological, intensified and market-oriented industry by adjusting the means of production and agricultural economy structure. It plays an important role for the fact that China has the largest population, so achieving

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the agricultural modernization has always been the orientation of agricultural development that the Chinese government adheres to. The agricultural modernization in China has made remarkable progress over the past 30 years since the reform and opening, while the agricultural modernization is a dynamic, regional, holistic process and its construction and development change with time, which suggests that the use of quantitative methods to scientifically and objectively evaluate the level of agricultural modernization has great realistic meaning that helps the government better master the process of agricultural modernization. Furthermore, finding out the factors that promote the development also has guiding significance.

At present, the study of agricultural modernization is mainly based on qualitative research methods and few papers use quantitative methods. One of the quantitative research methods they prefer to use is multi-index comprehensive evaluation method. Caio et al [1] the index system based on the studies of other scholars and used statistical method like Spearman index to find out the main factors that influenced the agricultural modernization in Brazil. While researches on the comprehensive evaluation of agricultural modernization in China are concentrated in three areas:

- Cobb-Douglas model. This approach analyzes the contribution of capital, labor, science and technology to agricultural production in order to determine the process of agricultural modernization.
- Multi-index comprehensive evaluation method. This method uses principal component analysis, clustering analysis, gray relational analysis, comprehensive index evaluation method and other methods to find out all the factors and information, then uses mathematical method to treat them and finally confirms the overall dynamic process.
- DEA method. This method is focused on input-output factors to evaluate the level of agricultural modernization by comparing the input and output of the agricultural sector as well as their respective advantages.

The second method is the most used one as we mentioned before. Shen and Hu [2] used clustering analysis, principal component analysis and AHP method to improve the tedious agricultural modernization evaluation index system. Meng and Sun [3] applied entropy weight theory to determine the weight of rating system indicators, and then calculated the composite index of the development level of modern agriculture and subsystem development level index of Huhan province. Wang [4] did the same for 108 counties of Henan province based on the theory of fixed-weight-grey-clustering, and sorting as well as comparison was also made. In the end of this paper, the strategies for agricultural development were given. Jiang and Huang [5] built the agricultural modernization evaluation index system by using AHP and evaluated the general development level of China based on that. Yang and Guo [6] brought factor analysis method to artificial neural network and used it in the multi-index comprehensive evaluation of agricultural modernization, which made the artificial neural network overcome the lack of precision in the multi-index case and put forward new ideas for the agricultural modernization comprehensive evaluation method. Wei [7] conducted comparative analysis of the course of rural mod-