Analysis of Dairy Supply Chain Efficiency Based on Stochastic Cost Frontier

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Abstract

In recent years, the living standards have greatly increased. Consumers' demand for dairy products is increasing. Each region is eager to develop the dairy industry, which leads to intensified competition in the dairy industry and the decline in profits of related entities. Solving the problem of dairy product efficiency has become a hot topic today. This article uses frontier4.1 software to measure the cost efficiency of raw milk production in the dairy supply chain. The results show that raw milk production costs are inefficient.

Keywords

Stochastic Cost Frontier; Dairy Supply Chain.

1. Introduction

In recent years, with the rapid development of China's economy and the significant increase in living standards, people's dietary structure is also developing toward nutrition and science. Consumers' demand for dairy products is increasing, and then each major The comprehensive production capacity of dairy products companies has been significantly enhanced. The dairy industry is one of the most dynamic industries, and its regionally-related industries are also booming. At the same time, various regions are rushing to develop the dairy industry. This has led to increased competition in the dairy industry and the decline in profits of related entities, highlighting the efficiency of the dairy industry. The efficiency needs improvement.

The question of the efficiency of the dairy industry has always been the focus of domestic and foreign scholars. Lu Ning et al. [1] (2010) used the provincial panel data of the Chinese dairy industry from 1998 to 2007 and used the stochastic frontier production function method (SFA) to analyze changes in the production technology efficiency of the Chinese dairy industry. Du Fenglian et al. [2] (2013) used the stochastic frontier method (SFA) to measure the economic efficiency, technical efficiency, and allocation efficiency of different raw milk production modes, and used the Tobit model to analyze the factors affecting raw milk production efficiency. Liu Junhua, Li Yanxia [3] (2014) reviewed the related research on the efficiency measurement of dairy supply chain, and pointed out that one of the focuses of dairy supply chain efficiency is to consider the efficiency measurement under the complex network structure within the supply chain, the network DEA model and its derived supply. Chain DEA model is the main research method. Liu Junhua et al. [4] (2015) used the DEA-Malmquist index method to study the efficiency changes in the dairy industry chain development in 31 administrative regions between 2011 and 2012 in China. Liu Junhua, Zhang Jing, et al. [5] (2017) investigated the production and operation conditions and supply chain structure of each part of the liquid milk upstream of B dairy product group, selected appropriate evaluation indicators, and constructed a KH efficiency evaluation that meets the actual production "open black box". The model measures the efficiency of 31 DMUs with a tree structure. Kaveh Khalili-Damghani et al. [6] (2011) proposed to measure supply chain agility efficiency based on a fuzzy DEA and simulated hybrid method and apply it to the top ten Iranian dairy supply chain companies to measure efficiency under actual conditions. . Mor S et al. [7] (2012) used the random production frontier function method to study the

technical efficiency of small dairy farmers in India. The results showed that dairy farmers as part of the cooperative supply chain were compared with dairy farmers who did not follow this production model. Technically more efficient.

The existing literature shows that the methods for the study of dairy industry efficiency include the SFA method with parameters and the non-parametric DEA method. The research on dairy industry efficiency focuses on the technical efficiency of the production stage. However, few people consider the efficiency of the dairy industry from the perspective of cost. Only Du Fenglian [2] (2013) uses randomized cost fronts to estimate the technical efficiency and configuration efficiency of dairy raw milk production processes in Hohhot; based on economic efficiency, technical efficiency, and configuration efficiency. The relationship between the calculation of the corresponding economic efficiency. Although it is important to measure the technical efficiency of the dairy industry to improve the efficiency of the enterprise, the economic efficiency obtained through the stochastic cost frontier function method also provides the enterprise with a different idea of improving its own benefits.

This article is based on the statistical data of 17 dairy industrial chains using large-scale dairy farming in 2015 as a sample, measures the economic efficiency through the random cost front method, and analyzes the cost efficiency of dairy products in various provinces and cities. The result will be the development of the national dairy industry in the future. It has guiding significance.

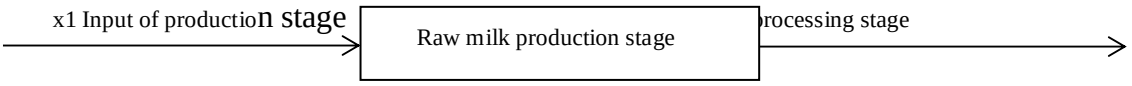

Fig.1 Structure of the dairy industry chain

2. Basic model and method

2.1 Stochastic frontier production function

Farrell (1857) [8] introduced frontier analysis to measure efficiency. This method is consistent with the optimization objectives of the production function, cost function, and profit function in microeconomic theory and is considered as an objective and reasonable method for studying the efficiency of decision units. Aigner et al. (1977) [9] proposed the Stochastic Frontier Analysis to measure the technical efficiency, and proposed a stochastic frontier production function, which marked the emergence of stochastic frontier analysis theory. The stochastic frontier production function model of Battese and Coelli (1995) [10] is:

$$\ln q_i = x_i'\beta + v_i - u_i$$

Where q_i denotes the ith vendor output; x_i denotes a K × 1 dimensional vector consisting of the logarithm of the input; β denotes an unknown parameter vector; v_i statistics the symmetric random error term of the noise; u_i denotes the non-negative associated with technical invalidity Random Variables.

2.2 Stochastic frontier cost function

Schmidt and Lovell (1979)[11] proposed the stochastic cost frontier model as:

$$\ln(c_i/w_{ni}) = x_i'\beta + v_i + u_i$$

Where c_i denotes the observed cost of vendor i; w_{ni} denotes the price of the nth input; x_i denotes a K × 1 -dimensional vector consisting of the logarithm of the input; β denotes the unknown parameter vector; v_i statistical noise is a symmetric random error term; u_i Represents non-negative random variables related to cost inefficiencies.

The cost efficiency measure, which is the ratio of the minimum cost to the cost of observation, yields:

$CE_i = \exp(-u_i)$

3. Variable selection and data description

Nowadays, the rapid development of dairy processing industry in China, the traditional mode of free-range and small-scale family farming has become increasingly unsuited to the needs of industry development, and the number has gradually decreased, while the scale of grazing land in the form of farming communities, dairy cooperatives and own farms is in the Gradually improve. Therefore, in this study, 17 regions using large-scale dairy farming methods in 2015 were used as statistical data samples, and the data was derived from the 2016 China Dairy Industry Yearbook. The evaluation indicators were selected as follows: Input indicators for the raw milk production stage were production input (yuan/head.year) and land input (yuan/head.year); the final product was raw milk cost price (yuan/kg).

4. Results and analysis

This article uses the Frontier4.1 program to estimate all unknown parameters in the above cost model. According to the software results, the average cost efficiency of the 17 regions is about 10.01%. It shows that today's domestic raw milk production is not efficient.

Analysis of the reasons for the ineffectiveness of raw milk costs: The average inefficiency in the sample was 10.01%, that is, about 10.01% of the expenditure was wasted or could not be reasonably explained. It was further found that the amount of land invested in the production of raw milk in the eastern region was relatively large, which in turn led to a lower raw milk efficiency. How to solve this inefficient method is to increase the scale of feeding, make the land use as much as possible, increase the utilization rate of the land, reduce the inefficiency of the raw milk production cost, and increase the economic benefits of raw milk.

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