Production Performance Analysis in Vietnam Fisheries Industry

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Abstract:
The objective of this article is to review methods to evaluate production efficiency of enterprises, then propose a method of evaluating production efficiency for Vietnam's seafood industry. There are many methods of production efficiency analysis that have been used. In the article, we review basic methods such as analysis of financial performance, analysis of production efficiency. From there, we evaluate the factors affecting production efficiency and analyze the advantages and disadvantages of these methods.

Keywords: Production performance analysis, fisheries industry, Vietnam

1. Introduction

Before 2010, in Vietnam, the method of measuring production efficiency through the use of data coverage methods - Data Envelopment Analysis (DEA) and random boundary analysis - Stochastic Frontier Analysis (SFA) was not used. Since 2010 until now, the use of these two methods has become popular in Vietnam. However, in the fisheries sector, especially for the pangasius industry, the majority of authors use DEA, very rare cases of using SFA, as well as using two methods simultaneously. For DEA, besides, there are two major advantages that it is not necessary to define the appropriate form of production function and is applied to analyze production efficiency in the case of many inputs and outputs. However, the use of DEA also has two limitations, such as not considering the effects of external random factors and the errors caused by non-efficacy. On the contrary, SFA has advantages and disadvantages of DEA as just mentioned (Ali and Lerme, 1997). Meanwhile, for the aquaculture sector in general and the pangasius industry in particular, the production process is affected by many uncontrollable external factors. Therefore, in this study, the production efficiency measurement method through the use of SFA is used, in order to complement the empirical studies in measuring production efficiency.

Since the early 2000s, seafood has been one of the industries providing many key export products of Vietnam to the world market, typically shrimp and pangasius. In 2012, the industry's export turnover accounted for 5.3% of the country's total export turnover, equivalent to US $ 6.09 billion. Especially since Vietnam officially joined the World Trade Organization (WTO) in 2006, the industry's export turnover increased by an average of 10.4% in the period 2006-2012 (General Department of Customs, two thousand and thirteen). Also according to the official data of the General Department of Customs, by the end of the first 11 months of 2017, seafood export turnover reached US $ 7.6 billion, although there was a decrease in the US market by nearly 2%, but offset by an average growth of nearly 20% / year in the next four major seafood import markets of Vietnam, including Europe (EU), Japan, China and Korea (General Department of Customs, 2017). This shows that seafood in Vietnam plays a very important role in generating foreign currency for the country. By 2017, the four largest import markets for Vietnam's seafood products are still the United States, the European Union (EU), Japan and South Korea, accounting for 64% of the country's total seafood export turnover. (General Department of Customs, 2018).

In the period 2006-2011, the industry's export turnover increased by an average of 12.8% per year, but by the period 2012-2017, this figure was only 6.3% (VASEP, 2006, 2012 and 2018). The average annual growth rate of seafood export turnover has decreased mainly due to many factors that adversely affect the industry's export in 2015, such as increased anti-dumping tax on pangasius; fluctuations in the exchange rate towards the decrease in the value of the Vietnamese dong (VND) against the foreign currencies USD, EURO and Yen; the export volume of shrimp, pangasius and tuna (which are the three main products of the industry).
decreased sharply; The EU and the US strengthen the management and supervision of fishing products and technical barriers of Vietnam's seafood importing countries are increasing. In particular, at the end of November 2015, the United States Department of Agriculture (USDA) decided to implement the Catfish Monitoring Program (FSIS) for pangasius imported into this market (effective in March / 2016) caused a significant decrease in Vietnam's pangasius export volume.

2. Literature review

2.1. Financial performance analysis

Many researchers, especially those in the field of aquaculture engineering, often use simple financial performance analysis to evaluate the production efficiency of aquaculture households. Studies using this method mostly show the production efficiency of farming households through indicators such as yield, profit per hectare, profit margin. For example, Nguyen Thanh Long conducted a study on the square-head perch culture model of 45 square-headed perch farming households in Hau Giang province in 2015, using the profit target of 1 hectare to evaluate the effectiveness. production of these farming households. As a result, households with square head perch in Hau Giang achieved an average yield of 84.7 tons / ha. With this farming productivity, the author pointed out that the farmers have an average loss of 37.4 million VND / ha and 54.8% of the farmers have a loss from this farming model. In 2014, Tran Hoang Tuan and his colleagues also conducted a study to evaluate the production efficiency of snakehead fish farmers in An Giang and Tra Vinh provinces, through the use of indicators of farming productivity. At the same time, using t-test to test the differences in culture productivity between the two provinces. The results of the study show that there is no statistically significant difference in culture productivity between the two provinces. In 2007, Phuong and her colleagues conducted a study comparing the financial performance of pangasius farmers in An Giang by 3 different modes of feed consumption: the group of households using completely homemade feed, The group uses completely the industrial feed and the group of farmers uses a combination of one part of homemade feed and one part of industrial feed. After analysis, Phuong pointed out that there is a big difference between households raising under 3 different forms. In particular, the households using a combination of industrial and homemade feed achieved the highest yield (nearly 244 tons / ha / year), followed by the group of households using industrial food (240 tons / ha / year) and lowest is the group of households using homemade feed (157 tons / ha / year) because the food conversion coefficient of this group of households is the highest. Similarly, Phan Thi Ngoc Khuyen (2007) and Le Xuan Sinh (2011) conducted a study to evaluate the efficiency of pangasius production in Ben Tre and Dong Thap provinces and in the Mekong Delta, through the use of productivity of farming households. Research results have shown that catfish farming at the time of the study is quite effective. Specifically, the average yield reached 337 tons / ha / crop, and the profit per hectare / crop was 366 million and 514 million in Ben Tre and Dong Thap respectively. In another study by Oanh & Minh (2011), the author also used indicators of financial efficiency to evaluate production efficiency among groups of households with and without participation. horizontal link in the pangasius production process. The author concludes that the financial efficiency of households engaged in vertical production is higher than that of individual producers. The profit margins of these two forms of production organization are 3.93% and 3.89%, respectively. According to the research results on the efficiency of pangasius production of farmers with different sizes of Le Xuan Sinh (2011), it shows that the average yield of farming households in the Mekong Delta is 275.7 tons / ha / crop. In which, small-scale farmers have a yield of 290.6 tons; the average scale is 252.4 tons and the large scale is 285.2 tons. Research results show that small-scale farmers have the highest income (4.68 billion / ha / crop); while households with an average farming size of 4.04 billion VND, while the average income is 4.45 billion VND / ha / crop. This results in the fact that smallholder farmers are not profitable, while those with more than 1 ha have the highest profit (128 million VND / ha / crop) relative to the average profit. average is nearly 68 million. This result shows that, for small-scale farmers, despite having the highest yield and income per hectare / crop, they have the lowest profit / ha / crop. In another study by Le Van Gia Nho et al. (2012) showed that there is a big difference in tra fish farming productivity among farming households in the Mekong Delta.
2.2. Analysis of production efficiency using Data Envelopment Analysis - DEA method

Although the use of financial efficiency analysis to measure the production efficiency of aquaculture households also reflects the performance of production households. However, the results obtained from this approach are strongly influenced by changes from the external business environment, as well as from changes in natural conditions. In addition, a production performance rating based on financial performance analysis does not indicate a technique to combine inputs with available input prices. Therefore, economic researchers have approached to assess production efficiency based on DEA and SFA analysis tools to measure technical efficiency (TE), efficiency of resource distribution - Allocative efficiency (AE), cost efficiency (CE) or economic efficiency (EE) and scale efficiency (SE) for producers.

Measuring production efficiency using DEA

Over the years, in the fisheries sector, many researchers have used DEA to measure the production efficiency of the industry or of households. Specifically, Sharma et al (1999) applied DEA to calculate the economic efficiency of carp farmers in China. The results of the study have shown that farmers should increase the rate of grass carp and reduce the rate of black carp in the culture structure. In addition, research results also show that small-scale farmers have higher technical and economic efficiency than large-scale households.

Kaliba and Angle (2004), through the application of DEA to calculate CE and SE. The results of the study have shown that most catfish farmers in Arkansas (the southern United States) are able to produce more efficiently by modifying their combination of input factors, rather than by modifying their use of input factors. scale operations.

Another study by Cinamre (2006) has shown that salmon farming households in the Black Sea region of Turkey can reduce their labor and feed costs by 32% to achieve maximum cost effectiveness. (CE is calculated as 0.68). This means that producers can reduce their total cost by 32%, but still be able to maintain a constant level of production.

By 2008, in an Alam study it was shown that, although up to 50% of the production households with the carp-shrimp model in Bangladesh achieved complete technical efficiency (TE = 1), only 9% of households achieved CE, due to the ineffective distribution effect of using input factors, with low prices of available inputs (AE = 0.58).

In another study by Bui Le Thai Hanh (2009), the author used the DEA method to measure the effectiveness of TE under two constant-scale income assumptions - Constant Return to Scale (CRS) and regular income. Variable Return to Scale (VRS) for SE measurement in 61 pangasius farmers in An Giang province. The study results have shown that the efficiency coefficients of pangasius farming households in An Giang are TECRS = 0.59; TEVRS = 1.00 and SE = 0.58. In addition, the study results also show that farmers can increase the efficiency of scale by increasing production scale, since 92% of households that do not achieve scale efficiency fall into the case of scale income. Increasing Returns to Scale (IRS).

In 2010, Son used DEA to measure the production efficiency of Artemia farmers in the Mekong Delta. The results of the study have shown that Artemia farmers can cut production costs by 37% while maintaining the same level of production. The main cause of cost inefficiency is the inefficiency of TE. The study results also show that the average SE of the farming households is 83% and the majority of the farmers do not achieve scale efficiency, therefore, according to the author, the Artemia farming households can increase production scale to improve scale efficiency. In addition, the study results also showed that there is a difference in TE, AE and CE between Artemia farming households under 3 forms: Artemia 1 cycle, 2 cycle and Artemia farming households combined with salt making, at 10%, 10% and 1% significance levels respectively.

In 2011, Dang Hoang Xuan Huy used DEA to analyze TE of Clarias fish farmers in the Mekong Delta. The goal of this study is to analyze TE, to make recommendations to reduce the input use of farmers. The
research results show that 18% of the farmers reach complete TE, 82% do not reach complete TE in the Mekong Delta.

In 2014, Quynh and Yabe used the DEA method to evaluate the production efficiency of shrimp farmers combined with fish and crab farming in the same pond. The author has shown that, although the farming households achieve relatively high technical efficiency (TE = 80.04%), economic efficiency is only average (EE = 55.32%). This indicates that farmers still have the potential to improve production efficiency through improving distribution efficiency (current distribution efficiency is only 64.16%). In other words, farmers are limited in matching inputs with their existing prices. It is this reason that leads to households using too much feed, on the one hand increases costs, on the other hand increases the level of water pollution in the pond due to the accumulation of leftovers. In addition, the author also proposed the optimal density of aquatic species in the same pond is 8.15 shrimp, 1.59 crabs and 2.46 fish per 1 m² of pond. The study results also show that small-scale farmers achieve higher production efficiency than large-scale households, the optimal farming scale for this model is less than 0.5 ha / pond.

Lam A. Nguyen et al (2017) conducted a study to evaluate the follow-up effects of flooding and saline intrusion, as well as to evaluate sustainable adaptation strategies to catfish farming. How in the Mekong Delta, Vietnam to the production efficiency of farming households like, through the survey of catfish farming households in the region. The study results showed that TE of pangasius farmers in the study with the assumption of constant scale income and variable scale income was 0.66 and 0.84, respectively. The author also pointed out that pangasius farmers in the lower Mekong Delta provinces achieved higher TE than those in the upstream areas due to lower cost of energy use and only one crop per year with a lower stocking density. Meanwhile, farmers in the middle and upstream regions of the Mekong Delta have to pay for pumping water during the flood season and raise at least 3 crops in 2 years. In addition, the author also found that the education level of farmers and those experienced in coping with climate change has a positive and significant impact on TE.

In 2015, Lliyasu also used DEA to measure and evaluate TE of freshwater fish farmers in Malaysia. Research results show that all the farmers have not reached complete TE. The authors also pointed out that household size, farming experience of farming households and access to extension services have a positive and significant impact on TE. Meanwhile, the age of the farming households has the opposite effect on TE. Besides, the educational level of farming households has a positive, but not statistically significant, impact on TE of farming households.

Le Van Thap et al (2016) used DEA technique to measure and explain TE of Vannamei farming in the form of intensive farming in Ninh Thuan province, Vietnam. Research results have shown that there is a significant room for the improvement of TE for intensive white leg shrimp farming in Ninh Thuan. In addition, the authors also found that the size of the cultured area has a significant and positive effect on TE. In contrast, farming time and financial stress have a negative impact on TE.

Angui Christian Dorgeles Kevin Aboua (2017) performed an analysis of resource use and economic efficiency of 32 fish farmers in the Southeast of Côte d’Ivoire by using the DEA model. The analytical results show that these households have not very high efficiency, specifically the average TE is 0.738 and the average EE is 0.553. In addition, the study also shows that the farmers using industrial feed have higher TE and EE efficiency than those using other types of feed. In addition, the study results also show that the farming households have used excess resources (labor, machinery, equipment, farming area) and thus led to a decrease in production. The author argues that, if the households reduce their excess use of resources, they can increase their output by about 17%.

In summary, in the fisheries sector, there are quite a few domestic and foreign authors applying DEA to measure the production efficiency of producers, and also show that, not all All production households achieve
optimal TE and CE. Most aquaculture producers still have room to increase their production efficiency by using more efficient combination of inputs, corresponding to production techniques and available input prices.

2.3. Measuring production efficiency using SFA

In addition to using DEA to measure the production efficiency of the industry or of producers, there have been many domestic and foreign studies using SFA to measure the production efficiency of producers in the sector. Seafood.

In 2005, Alam et al. used a random marginal cost function to evaluate the efficiency of fish production in Bangladesh. The economic inefficiency model is estimated at the same time with random margins to analyze the factors that have a significant impact on the production efficiency of farming households. The research results show that the factors of production age and experience have a significant impact on production costs. Specifically, the cost of fish production decreases as production age and experience increase. In addition, the author also points out that households with large-scale farms, in terms of economics, are less efficient than small-scale farmers. From this research result, the author has given policy implications to improve the efficiency of farming households, including expanding agricultural extension services and improving education level for farmers.

In 2007, Den. DT. and CTG conducted a TE measurement study of shrimp farmers in the Mekong Delta, using the SFA method. Also, in 2010, Nguyen Hong Phong used SFA to measure the production efficiency of pangasius farmers in the Mekong Delta. Research results show that TE ratio of pangasius farming households in the Mekong Delta is relatively high (85.5%). In another study by Huynh Truong Huy (2009), through the use of SFA method has shown that up to 82% of farmers in the Mekong Delta pangasius farming do not achieve complete technical efficiency. Average TE of farm households is at 59%. The two types of costs that account for the highest proportion in the production cost of raw pangasius are feed and seed costs (about 80% of production costs). Huy's research results show that pangasius producers can improve their TE by reducing the cost of using inputs. Specifically, households can reduce their inputs by 20-60%. In particular, these 2 cost items alone can be reduced by 20-35%. The research results also show that large-scale households (quantity of pangasius production) achieve a higher level of technical efficiency compared to households with a smaller production scale.

Singh (2008) performed research to analyze the production efficiency of fish farmers in Tripura district of India, through the use of SFA. Research results show that there are still many opportunities for farmers to improve their economic efficiency since the EE ratio is only 44%. Therefore, according to the author, the farming households here can increase their production by 44% with available input and technology.

Edward Ebo Onumah (2011) used SFA to look at the productivity of hired labor and family labor, as well as other factors that have a significant impact on technical inefficiency in fish farmers. Ghana. Research results show that household labor, hired labor, food, breeders, land and access to agricultural extension services of farmers have a significant impact on the produce random margins. In addition, the author also found that the use of family labor and hired labor are equally productive.

Also in 2011, Adinya and colleagues used SFA to analyze TE of fish farmers in Nigeria. Also in 2011, Onumah and Acquah used SFA to analyze TE of 150 fish farmers in Ghana. The results of these two studies indicated that small-scale fish farmers achieved higher TE than large-scale farmers.

In 2014, Crentsil and Essilfie used SFA to measure the TE of fish farmers in Ghana. The results of the study have shown that fish farmers here can reduce the inputs by 26.12% at the same time, but still keep the production level unchanged. In addition, the author also determined that in addition to factors such as food, breed and labor, it has a positive and significant effect on TE. In addition, the research results also show that, education level issues, marital status, participation in farmer groups, and access to extension services have a good impact on TE.
Begum and Hossain (2015) used SFA to measure TE of shrimp farmers in coastal areas of Bangladesh. The authors collected information on 180 shrimp farmers here to estimate TE. The results of the study have shown that shrimp farmers here do not reach full TE and they can increase yields by nearly 28% with available farming techniques and inputs. The authors also emphasized that, for a country as narrow as Bangladesh, this increased result could significantly increase the income of farming households, and thus contribute to improved livelihoods for farmers. In addition, the research results also show that the farmer's education level, participation in technical training courses, age and quality of water sources have a significant impact on the efficiency.

In 2015, in an author's study on the production efficiency of pangasius farming households in An Giang, through the use of SFA method to evaluate the production efficiency of pangasius farmers in An Giang. The research results show that pangasius farmers here can cut costs by 29%, but still maintain a constant level of output. In addition, the results of the study also showed that farmers using certified free seed and high educational attainment had higher production efficiency than those who did not use certified free and have a low education level.

Ogunmefun and Achike (2018) used SFA to estimate the TE of 120 fish farmers in Lagos State, Nigeria. The research results have shown that the farmers in the study achieved a high TE (88%) and there are 3 factors that have a positive and significant effect on farmed fish production, including: labor, storage capacity, and the amortization of fixed assets, while farm size and feed have the opposite effect.

In summary, besides using DEA to measure production efficiency, SFA is also used to measure the production efficiency of aquaculture producers. Most of the research results have also shown that there are 3 inputs that account for the highest cost proportion in the farming of raw pangasius, which are breeds, aqua feed and labor use. (including family and hired labor). In addition, the research results also show that not all production households achieve optimal efficiency, as well as production efficiency is higher each time producers have the ability to combine reasonable inputs, corresponding to production techniques and prices of available inputs. The research results from the authors who used DEA and SFA as mentioned in this section have drawn many practical conclusions for aquaculture farmers such as: expanding production scale. does not always bring high production efficiency (Sharman et al., 1999). Like the research results of Kaliba and Angle (2004) stated that, in order to raise CE, catfish farmers in the Arkansas Subcommittee of the South of the United States should adjust the coordination of using corresponding input factors. with their prices, rather than expanding production scale. Onumah and Acquah (2011) also reached similar conclusions in their study on 150 fish farmers in Ghana. In order to raise CE, aquaculture households need to reduce the excess use of inputs such as hired labor, aquatic feed (Cinamre et al., 2006) and select cultured species with economic value. high (Singh et al., 2000). However, the combination of inputs in accordance with technical requirements does not necessarily lead to optimal CE. Instead, farmers need to consider changing the prices of the inputs (Alam and Murshed, 2008).

3. Evaluate the factors affecting production performance

In addition to measuring, evaluating and comparing the production efficiency of producers, researchers also analyze and identify factors that have a significant impact on production efficiency, by using using some econometric methods such as using the 2-step analysis method. In which, step 1 is to estimate the efficiency coefficients (TE and CE). Then, go to step 2, using regression method (using Tobit function) to regress the variables of socio-economic characteristics of the household on the efficiency coefficients to determine the factors with or without effect. significance to the efficiency coefficients. Or, using a one-step approach, by regressing variables on the socio-economic characteristics of producers on the inefficiency of producers to determine the factors that have and have no effect on production inefficiency of production households.

The results of the literature review show that there are many factors affecting the production efficiency of aquaculture households, such as age. According to the research results of Alam et al (2005) and Begum and

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Hossain (2015), the older the main farmers in the fish and shrimp producers in Bangladesh, the higher the production efficiency.

Almost all previous studies have shown that the higher the education level of the main aquaculturist in the household, the higher the production efficiency (Lam A, 2017; Lliyasu, 2015; Alam et al., 2005; Crentsil and Essilfie, 2014; Begum and Hossain, 2015; Author, 2015; Singh et al. 2009). In contrast, Singh et al. (2009) found that educational attainment had no significant effect on the production efficiency of freshwater aquaculture in India. Likewise, Larry (2017), while doing a study on the production efficiency of fishermen in Maasim Saranggani province, Philippines, showed that educational attainment had no significant impact on TE of farmers. Samah (2016) conducted a study analyzing the efficiency of fish production systems in aquariums in Negeri Kedah and Pulau Pinang, Malaysia and found that educational attainment has a positive and significant effect on TE of farmers, different from the research results of Sanusi et al (2016) when conducting a study on the production efficiency of fish farming in Ibadan-Ibarapa region of Oyo State, Nigeria.

Previous research results have also shown that households that have access to agricultural extension services have higher production efficiency than households that do not (Lliyasu, 2015; Alam et al, 2005; Onumah, 2010; Crentsil and Essilfie, 2014).

Production experience of aquaculture households, according to results of previous studies, also has a good influence on production efficiency (Larry, 2017; Lliyasu, 2015; Alam et al, 2005; Bui Le Thai Hanh, 2009 and Son, 2010) In addition, the research results of Jennifer K Sesabo et al (2010) also suggest that production experience has a positive and significant impact on the TE of fish farming households. small tissue in the coastal villages of Tanzania. Likewise, Son (2010) has shown that production experience has a positive and significant effect at the 10% to TE and 1% on the CE level of the Artemia farmers in the Mekong Delta. However, according to research results of Singh et al., 2009, production experience did not have a significant effect on TE of catfish farmers in Edo State of Nigeria, different from research results of Sanusi et al. (2016) when conducting research on the production efficiency of fish farming in the Ibadan-Ibarapa region of the State of Oyo, Nigeria.

There are conflicting results on the effect of area size on production efficiency of aquaculture households. Specifically, Le Van Thap et al (2016) discovered that the larger white shrimp farmers in Ninh Thuan, Vietnam, the larger the size of the farming area, the higher the TE. A study evaluating the production efficiency of shrimp farming households in Den (2007) also has the same evaluation. Samah (2016) conducted a study analyzing the efficiency of fish production systems in aquariums in Negeri Kedah and Pulau Pinang, Malaysia also found that the size of the cultured area has a positive and significant effect. According to the research results of Sanusi et al (2016) when conducting a study on the production efficiency of fish farming in the Ibadan-Ibarapa region of the State of Oyo, Nigeria. Meanwhile, Sharma (1999) said that, the carp farmers in China with small-scale farming area achieved higher production efficiency than households with large-scale farming area. Quynh and Yabe (2007) also have similar assessment when conducting a study on factors affecting production efficiency of aquaculture households in the Mekong Delta. Alam et al (2011) and Adinya et al (2011) have the same conclusion for fish farmers in Bangladesh and Nigeria. Likewise, Ogunmefun S.O and Achike A.J (2018) said that fish farmers in Lagos state, Nigeria with large scale of farming area achieved lower production efficiency than those with small farming area.

According to a study by Lliyasu (2015), family size has a positive effect on production efficiency of freshwater fish farmers in Malaysia. In addition, there are a number of other factors such as the quality of fingerlings and water sources for aquaculture (Huynh Truong Huy et al., 2009) that also affect the production efficiency of aquaculture households in the Mekong Delta.

In addition to the above factors, previous studies also show that participating households link together to connect with buyers and input suppliers more effectively than non-participating households. link (Vo Thi Thanh Loc, 2009). In addition, the study of Singh et al (2009) on the production efficiency of freshwater aquaculture in India showed that, attending technical training courses, had no significant effect on TE. of farming households.
According to Huynh Truong Huy et al (2009), farmers’ ability to access market information also positively affects production efficiency.

In summary, according to research results of domestic and foreign authors in the fishery sector, there are many internal and external factors affecting the production efficiency of aquaculture households. In which, there are a number of factors that are interested by many previous research authors and are also consistent with the current actual production context of pangasius farming households. These factors include: farming experiences in production; education level of main farmers in farming households; access to extension services through participation in training courses; ability to link the market; the level of participation of family and hired labor; use disease-free seed sources and cultured area size. These factors will be tested in the case of this thesis, through the econometric model to evaluate their impact on technical inefficiency and cost in Chapter 5 of this thesis.

5. Advantages and disadvantages of using two models DEA and SFA to measure production performance

Compared with SFA, DEA has advantages such as: being able to estimate the efficiency of producers using a lot of inputs to produce many output products, thus avoiding the situation of calculating the efficiency of a single input or an output product; being able to determine the amount of input used or the level of output produced by each producer in order to achieve full efficiency; It is not required to define the marginal production function format and the error distribution pattern. However, DEA has a number of limitations such as: not taking into account statistical errors (eg error brought about in measurement, weather, social events); extreme observations; Estimated results are very sensitive to small changes when adding or removing the number of observations in the survey sample; In the case of a small sample size, it is easy for the surveyed and assessed households to achieve TE.

SFA has two main advantages over DEA, including: SFA allows to significantly reduce the effect of statistical errors and extreme observations on estimation results; The estimated results obtained are less likely to change with the addition of the number of observations or a change in the type of production function used. However, the SFA has the following limitations: the form of production function is not pre-selected, so it is often arbitrarily chosen by using available information about the behavioral assumptions of households. estimated output (like cost minimization, profit maximization); the distribution form of the random variable describing the technical inefficiency of the estimated producers was also not determined from the outset, leading to the subjectivity of the estimation results; SFA has the advantage in cases where households create 1 output product or use only one input factor. Where a producer uses multiple inputs to produce more than one output, either the inputs, or the outputs, must be aggregated into a single measure when their prices are known.

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