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RESEARCH ON TECHNICAL EFFICIENCY AND TOTAL FACTOR PRODUCTIVITY IN VIETNAMESE SEAFOOD PROCESSING INDUSTRY

Major: ECONOMIC MANAGEMENT
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SUMMARY OF THESIS

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INTRODUCTION

1. Rational of the topic

Economic theories all show that the main source of economic growth is the growth of production inputs and improving efficiency and productivity (Solow, 1957; Lucas, 1988, Romer, 1994). Efficiency refers to the global relationship between all output and inputs in a production process, and firms are concerned with efficiency to achieve production goals (Speelman et al., 2007). The efficiency measures commonly used by economists today are technical efficiency, scale efficiency, allocative efficiency, and economic efficiency. Among them, the technical efficiency (TE) measure is widely used. It is the ability to minimize the amount of inputs to produce a given amount of outputs, or the ability to obtain maximum outputs from a given amount of inputs (Farell, 1957). Productivity is understood as the proportional relationship between outputs and inputs used. Through the stages of development, the concept of productivity has new insights, it simultaneously reflects efficiency and quality of production as well as quality of life at different levels. When measuring productivity, one can consider the productivity of each factor or all factors involved in the production process. When considering the productivity of each factor, it is called partial productivity, such as labor productivity or capital productivity. However, economists have shown that in the growth of production results, in addition to factors such as capital and labor, there is still a significant part increased thanks to other factors. The increases due to improving the efficiency of capital and labor use thanks to the impact of technological innovation, rationalization of production, improved management, improved labor qualifications... are called by economists as Total factor productivity (TFP). Today, improving TE and TFP is a particularly important issue for businesses, manufacturing industries, and the economy.

Simultaneous research on TE and TFP in manufacturing industries in general and the seafood processing industry in particular is important because it provides a wealth of information about performance and opportunities for improvement. TE indicates the optimal level of combining inputs with existing production technology. This will help the seafood processing industry determine

how the organization uses resources such as labor, materials, and technology to optimize the production process. Meanwhile, TFP indicates the contribution of other factors due to improving the efficiency of capital and labor use in output. Furthermore, the TFP growth decomposition also provides information about the factors (technical efficiency change, technological progress, and scale efficiency change) that promote or inhibit productivity. This helps the Vietnamese seafood processing industry comprehensively evaluate the efficiency of the production process. From there, it is possible to point out opportunities to improve technical efficiency or technology or expand (reduce) scale, in order to advance product quality and production efficiency. Furthermore, combining information from TE and TFP will help the seafood processing industry meet international standards and consumer needs, as well as build business strategies and sustainable development.

Vietnamese seafood processing industry is currently developing into a key economic sector, with large production value, taking the lead in international economic integration. Vietnamese seafood processing and export currently brings great value to the economy. According to data from the Vietnam Association of Seafood Exporters and Producers (VASEP), in 2022 seafood export turnover will reach about 11 billion USD, and Vietnam has become the third country in the world in producing, processing and exporting seafood. In addition, the seafood processing industry also creates jobs for millions of workers, creating motivation for the development of fishing and aquaculture. Although great achievements have been achieved in recent years, the seafood processing industry still has many limitations and inadequacies. During the period 2015-2020, Vietnam had an average of about 1,027 seafood processing firms operating each year. Of these, over 75% of seafood processing firms are micro, small and medium-sized firms. These firms are facing many difficulties in capital, labor and production technology. Most firms currently have low levels of production technology, mainly raw processing, so efficiency and productivity are still low, especially TE and TFP have not met the potential of the processing industry. Vietnamese seafood processing. In addition, in current analyzes of the efficiency and productivity of Vietnam's seafood processing industry, assuming all firms have the same production technology in

each period can lead to overestimates. Inaccurate amounts of TE and TFP of businesses. Furthermore, in analyzing the impact of factors on TE and TFP in the seafood processing industry, previous studies have only evaluated the impact of subjective factors belonging to the characteristics of the firm without mentioning them. Group of objective factors belonging to infrastructure and business environment. Therefore, there is not enough basis to build comprehensive solutions in improving TE and TFP in Vietnam's seafood processing industry.

Based on the above reasons, the PhD student chose the research topic "***Research on technical efficiency and total factor productivity in Vietnamese seafood processing industry***" to analyze TE and TFP in the seafood processing industry. Vietnamese seafood processing. At the same time, the topic will analyze the impact of a number of factors on TE and TFP in the seafood processing industry. From there, propose a system of solutions to improve efficiency and productivity, helping businesses in the Vietnamese seafood processing industry achieve better production and business results.

2. Purposes and tasks of the thesis

2.1. Purpose of the thesis

Research the theoretical and practical basis of TE and TFP in Vietnamese seafood processing industry, thereby building a scientific basis for solutions to improve TE and TFP in this industry.

2.2. Tasks of the thesis

✚ Literature review of TE and TFP at the firm level. Selecting a model to estimate TE and TFP for Vietnamese seafood processing industry.

✚ Analyze performance and estimate TE and TFP of Vietnamese seafood processing industry in the period 2015-2020.

✚ Estimate TE score, TFP and decompose TFP of Vietnamese seafood processing industry in the period 2015-2020. Thereby obtaining the efficiency score in production, the contribution of TFP to output, and analyzing the components of TFP growth (technical efficiency change; technological change; and scale efficiency change)

✚ Build and analyze a model of some factors affecting TE and TFP of Vietnamese seafood processing industry. Thereby evaluating the impact of factors belonging to the characteristics of the firm and factors belonging to the business environment on TE and TFP of the industry.

✚ Propose solutions and recommendations to improve TE and TFP of Vietnamese seafood processing industry.

3. The research questions

To achieve the research purpose, the thesis will focus on answering the following research questions:

(1) What is TE and TFP?

(2) What approaches are there in measuring and analyzing TE and TFP?

(3) How are the TE and TFP of Vietnamese seafood processing industry in the recent period?

(4) What factors affect TE and TFP of Vietnamese seafood processing industry?

(5) What are the issues raised and the solutions and recommendations that need to be implemented to improve TE and TFP of Vietnamese seafood processing industry?

4. Subject and scope of the thesis

• *Subject of the thesis*

Subject of the thesis is efficiency and productivity. However, these are broad concepts, so the thesis only considers two aspects: TE and TFP.

• *Scope of the thesis*

+ *Spatial scope of the thesis*: The research space of the thesis is firms in the Vietnamese seafood processing industry. Includes firms belonging to level 3 industry by three-digit 102 in the list of economic industries according to Decision 27/2018/QD-TTg of the Prime Minister (VSIC 2018). The thesis chooses the research context of Vietnamese seafood processing industry because: Firstly, consumption of seafood products still tends to increase globally, while natural aquatic resources are limited, and seafood supply increasingly relies on aquaculture activities. Along with the support of aquaculture technology, Vietnam has the advantage of a long coastline and a water surface area large enough to develop aquaculture in both brackish and freshwater. Of the total world shrimp production of about 6 million tons/year, Vietnam contributes about 1 million tons. In addition to shrimp, Vietnam also raises large quantities of pangasius, a source of white meat fish for the world. In addition, Vietnamese seafood is also considered a source of protein with stable quality and increasingly high nutritional value, contributing to ensuring food sources for people around the world. Second, Vietnamese seafood processing firms have the ability to catch up with the world in processing technology. In particular, focusing on deep processing with high value-added products, contributing to strengthening the industry's strength over the years. Third, Vietnam is increasingly integrating deeply and widely into the world economy through signing and implementing new generation free trade agreements (FTAs) with countries that are large seafood processing products consumption markets (Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), Vietnam-Europe Free Trade Agreement (EVFTA), Regional Comprehensive Economic Partnership Agreement (RCEP)). Therefore, the seafood processing industry has a particularly important role and position in Vietnamese manufacturing sector.

+ *Time scope of the thesis*: The thesis chose the research period of 06 years from 2015 to 2020 because: i) This period witnessed rapid development and important changes in the processing industry Vietnamese seafood, including technology, production scale and export market. ii) During this period, Vietnam has joined and implemented many new free trade agreements, which have affected the seafood processing industry by expanding markets and increasing competition. Research will help evaluate the impact of these factors on TE and TFP. iii) This period is marked by the emergence of new challenges such as climate change, epidemics, and increasing requirements for environmental protection. At the same time, there are also new opportunities from the application of advanced technology and innovation. In that way, research on TE and TFP during this period will provide a better understanding of how the industry faces and takes advantage of those challenges and opportunities. iv) Finally, research during this period also helps reflect and compare the development trend of Vietnamese fisheries industry with global and regional trends, thereby assessing the position and opportunities of industry in the international context.

Therefore, the thesis will conduct empirical research to analyze TE and TFP of the seafood processing industry during this period to gain an accurate perspective on the growth and sustainable development of the industry in the long term. The results from the thesis can provide useful information for orienting and planning the development of the fisheries sector in the future by looking at past and present performance and production capacity.

5. Research methods

To achieve the research objectives, the thesis applies the data envelopment analysis (DEA) approach in estimating TE, the Malmquist index model in decomposing changes in total factor productivity (TFPC) for Vietnamese seafood processing industry. The thesis also applies the semi-parametric method of Woolridge (2009) in estimating the contribution of TFP to output. At the same time, the thesis applies econometric regression models to panel data in analyzing factors affecting TE and TFP of the seafood processing industry such as: Tobit regression model to analyze the impact of factors on TE, Pooled ordinary least square linear regression model (POLS), Fixed effects model (FEM), Random effects model (REM),

Feasible generalized least squares model (FGLS), to evaluate the impact of factors on TFP. In addition, the thesis also uses methods such as descriptive statistics, analysis, synthesis, comparison... to analyze the current situation, estimate results as well as develop policy implications.

6. Scientific and practical contributions of the thesis

6.1. Scientific contributions

The thesis has analyzed approaches to measuring TE and TFP, thereby selecting a suitable model to estimate TE and TFP for the Vietnamese seafood processing industry. At the same time, the thesis has also analyzed the theoretical basis of factors affecting TE and TFP as a basis for building the empirical analysis model.

Based on data from the firm survey of Vietnamese seafood processing industry in the period 2015-2020, the thesis used a data envelopment analysis approach and a semi-parametric approach to estimate TE, TFP and decompose TFP. From there, the thesis analyzes TE and TFP by firm ownership and by firm size.

The thesis has built the empirical model to evaluate the impact of some factors on TE and TFP of Vietnamese seafood processing industry. Includes factors about internal firm characteristics such as innovation, technological innovation, and international trade activities. And factors about the production and business environment such as industrial parks and the quality of the local business environment.

6.2. Practical contributions

The estimated results of TE, contribution of TFP to output, and decomposition of TFP growth of Vietnamese seafood processing industry in the period 2015-2020 show:

The TE score of the industry is still low, the average is only 73.3%, meaning that Vietnamese seafood processing industry can cut the amount of inputs used by 26.7% and still produce the same amount of output. The average contribution of TFP to output is 2.124, which means improving the efficiency of capital and labor use under the impact of technological innovation, production rationalization, management improvement, and higher qualifications... make output of the industry increases by an average of 2,124 times. Decomposing TFP growth according to the Malmquist index model shows that TFP growth averages 2.0% per

year. Contribution to this growth was due to the contribution of technical efficiency change (TEC) and technological change (TC), with the same average rate of 1.0%. Meanwhile, TFP growth rate averaged 2.9% per year in the global Malmquist index model. And it is mainly contributed by the 2.5% rate of technology gap change (TGC) and 1.3% of technical efficiency change (TEC). However, the average decline in the rate of best practice change (BPC) is -0.9%, which is the reason that inhibits TFP growth of the industry. Furthermore, the analysis results also show that the biggest bottleneck in efficiency and productivity of the industry today is the small firms and the state-owned firms.

Regarding the factors affecting TE and TFP of the industry, the thesis has shown the influence of internal factors of businesses in the industry as well as objective factors on TFP, the empirical analysis results show that: export activities and firm age both have a positive impact on both TE and TFP. Meanwhile, the ratio of outstanding debt to equity and the state ownership have a negative impact on both TE and TFP. Besides, firm size has a positive impact on TE but a negative impact on TFP. In addition, factors such as the production environment and the quality of economic institutions all promote growth in both TE and TFP.

7. Structure of the thesis

In addition to the introduction, conclusion, references and appendices, the thesis is structured into five chapters following:

Chapter 1: Literature review on technical efficiency and total factor productivity

Chapter 2: Theoretical basis and research methods on TE and TFP for Vietnamese seafood processing industry

Chapter 3: Current status of technical efficiency and total factor productivity of Vietnamese seafood processing industry in the period 2015-2020

Chapter 4: Analysis of the impact of some factors on technical efficiency and total factor productivity of Vietnamese seafood processing industry

Chapter 5: Some solutions to improve technical efficiency and total factor productivity of Vietnamese seafood processing industry

Chapter 1:
LITERATURE REVIEW ON TECHNICAL EFFICIENCY AND TOTAL FACTOR PRODUCTIVITY

In this chapter, the author presents a literature review on measurement and analysis of TE and TFP at home and abroad. Overview of factors affecting TE and TFP. From there, the author points out the research gap and analytical framework of the thesis.

1.1. Literature review on technical efficiency and total factor productivity

1.1.1. Foreign studies

Although the concept of TE was born during the period of neoclassical economics, there was no interest in measuring it because it was assumed that firms always reached maximum TE. But Leibenstein (1966) pointed out the problems that exist between this theoretical assumption and empirical reality, so measuring it is extremely necessary. The basis for measuring TE begins with the description of the production technology. Production technologies can be represented by isoquants, production functions, cost functions or profit functions. Different technology descriptions will lead to different approaches for measuring TE. Although the analyzes based on these approaches have differences, they are all based on the same basic that TE is measured as the ratio between actual output and potential output. Meanwhile, productivity can be understood as the relationship between outputs and the inputs to produce the outputs. Partial productivity is simply calculated as the ratio of total output to a specific input, such as labor productivity or capital productivity. However, firms will change their production scale when affected by productivity shocks. When exposed to positive productivity shocks, firms respond by expanding production to increase outputs, thereby increasing demand for inputs. On the contrary, when experiencing negative productivity shocks, firms will cut output, so the demand for inputs will decrease. Therefore, TFP is measured by more complex techniques. Accurately estimating TE and TFP is a

fundamental problem in economics, a topic of interest to many economists. In economic theory, people often use the following basic approaches in measuring TE and TFP: Non-parametric methods; aggregate production function estimation methods and stochastic frontier methods.

1.1.2. Domestic studies

The quality of economic growth is determined by its constituent factors and how they interact with each other. Among these factors, TE and TFP are important criteria to evaluate the quality of a country's economic growth. To do this, there are many different quantitative methods in theory. However, most productivity studies are qualitative studies in Vietnam, so they do not clearly show the specific contribution of each input factor in the production process. And it has not specifically shown each aspect of the quality of economic growth.

1.2. Literature review on factors affecting technical efficiency and total factor productivity

Determining TE and TFP levels is important, but determining the origin of the factors that influence them is even more important (Timmer, 1971). In addition to the traditional factors that impact on the efficiency and productivity of firms, which are production factors such as capital and labor, there are other factors that also have a significant impact on the efficiency and productivity of firms. There have been many studies in the world as well as in Vietnam analyzing the factors affecting TE and TFP and they can be divided into two groups: i) Factors of the internal firm characteristics ii) Factors of the production and business environment.

1.2.1. Factors of internal firm characteristics
1.2.2. Factors of production and business environment
1.3. Achieved results, research gaps and analytical framework of the thesis
1.3.1. Results
1.3.2. Research gaps and analytical framework of the thesis

I found that the research topic on TE and TFP in the Vietnamese context still has shortcomings following:

Firstly, most studies on efficiency and productivity in Vietnam have only evaluated individual aspects such as capital efficiency and labor efficiency. There are few studies mentioning TE and TFP in the Vietnamese context, especially for the Vietnamese seafood processing industry. Therefore, there are no accurate assessment criteria as well as different aspects of TE and TFP of Vietnamese seafood processing industry.

Secondly, estimates of the contribution of TFP to output in some industries in Vietnam often use growth accounting technique or the two-step estimation procedure of Levinsohn & Petrin (2003), which takes the investment as a proxy for productivity shock. Meanwhile, model of Wooldridge (2009) is still rarely applied due to limitations in estimation procedures. Furthermore, traditional efficiency and productivity estimation models in Vietnam often assume that firms in the industry have the same production technology in each period, which may lead to biased estimates. In addition, the decomposition of TFP growth usually only stops at components such as technical efficiency change (TEC), technological change (TC), and very few studies mention components such as scale efficiency change (SEC) and technology gap change (TGC) in TFP. Therefore, there is no in-depth analysis of productivity.

Thirdly, the literature review shows that studies on assessing the impact of factors on TE and TFP often only stop at assessing the impact of factors related to internal firm characteristics. There are few studies analyzing the impact of production and business environment on TE and TFP. Furthermore, the factors are analyzed fragmentarily in studies without being comprehensively considered. Therefore, there are no recommendations suitable for firm sectors in the industry.

In this thesis, I will estimate TE score and contribution of TFP to output and decompose TFP growth, as well as analyze the model of factors affecting TE and TFP of the industry with the analytical framework shown in Figure 1.1 to fill the gaps mentioned above.
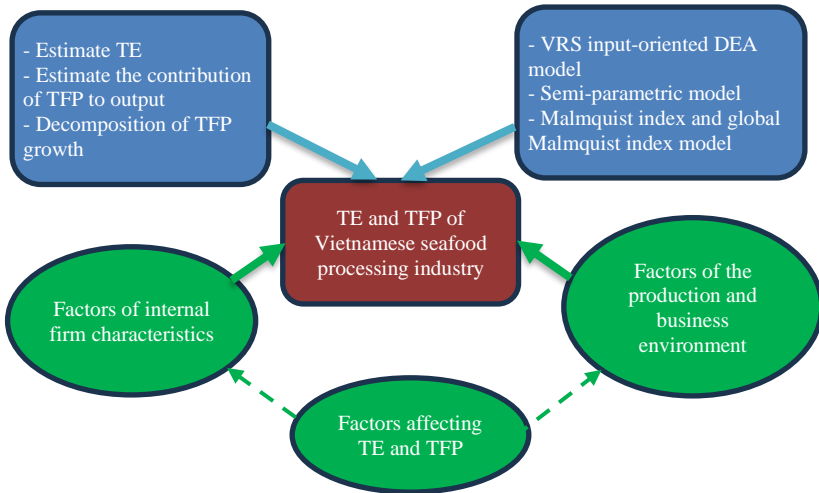
Figure 1. 1. Analytical framework of the thesis

Source: Created by the author

Chapter 2:
THEORETICAL BASIS AND RESEARCH METHODS ON TE AND TFP FOR VIETNAMESE SEAFOOD PROCESSING INDUSTRY

In this chapter, the author presents the concepts of TE and TFP as well as how to measure and analyze them. Besides, the author presents the methods that will be applied in the thesis to estimate TE score and contribution TFP to output, and decompose TFP growth of Vietnamese seafood processing industry. Finally, the thesis introduces data sources and processing methods, variables in the models and introduces the research sample. This data source is the basis for the thesis to describe the current situation of TE and TFP in Vietnamese seafood processing industry in chapter 3 as well as estimate empirical models in chapter 4.

2.1. Concepts of technical efficiency and total factor productivity

2.1.1. The concept of technical efficiency

The concept of efficiency in economics is a broad concept and has been described and developed by many economists as well as measures for it. Coelli et al (2005) said that "efficiency is the correlation between scarce inputs and output of goods and services. It is used to look at how well resources are distributed by markets." Thus, efficiency represents the correlation between outputs obtained compared to the inputs needed to produce that the outputs. It reflects the degree of success a firm achieves in allocating the inputs used and outputs produced to meet a certain objective. A firm will always try to organize resources into a production unit to achieve the ultimate goal of maximizing output or minimizing costs or maximizing profits or maximizing utility or a combination of all the above purposes (Oluwatayo et al., 2008). Corresponding to those goals are the concepts of technical efficiency (TE), economic efficiency (CE), allocative efficiency (AE) and scale efficiency (SE) (Speelman et al., 2007).

2.1.2. The concept of total factor productivity

The concept of firm productivity can be defined as the relationship between the total product a firm produces and the total resources it consumes to produce that product. The concept of departmental productivity is obtained when one applies productivity measures to each unit of resource, such as labor productivity or capital productivity. However, when all resource factors are combined to measure the total product, it is called the concept of total productivity (TFP) (Coelli et al., 2005). Although the concept of TFP was first introduced by Tinbergen (1942), it became widespread and popular through definition by Solow (1957). However, the limitation of the definition is the assumption that all firms apply best practices to achieve the highest technical efficiency and that technological change (TC) is the only factor generate TFP.

Leibenstein (1966) pointed out that the definition of TFP was flawed and showed that TC is not the only factor influencing TFP.

2.1.3. Decomposition of total factor productivity growth

2.2. Estimation methods to estimate TE and TFP for Vietnamese seafood processing industry

The thesis uses the DEA approach to estimate TE and decompose TFPC for the Vietnamese seafood processing industry. Because some of the advantages of DEA over SFA are: DEA does not require specific assumptions about the form of the production function, while SFA requires the identification of a specific objective function. This makes DEA more flexible when there is not much information about the production structure; DEA requires no assumptions about the distribution of errors, while SFA typically assumes a distribution of errors (usually a normal distribution); DEA easily handles multiple outputs and inputs at the same time without having to deal with the problem of the size of the Jacobi matrix, a complex problem that frequently appears in SFA. DEA has the ability to determine the "core productivity area" without defining an objective function; DEA makes no assumption of variance in productivity errors, whereas SFA typically assumes homogeneity of variance; DEA can determine linear and non-linear productivity, while SFA is usually limited to linear models.

In addition, the thesis applies a semi-parametric approach in estimating the contribution of TFP to output because of the following advantages: This approach allows to control variables that can affect productivity explicitly and helps reduce the problem of bias in yield estimates; It solves the endogeneity problem, especially when there are unobservable factors that simultaneously affect both productivity and control variables; There is flexibility in integrating functional controls into the regression model, helping to capture the complexity of the relationship between a explanatory variable and dependent variables; Can help identify, minimize errors and control fixed unknowns, helping to estimate productivity more accurately,

especially for panel data. For panel data, it is also capable of handling the problem of many unobservable variables and the simultaneity selection.

2.2.1. Technical efficiency estimation method

2.2.2. Method for estimating the contribution of total factor productivity to output

2.2.3. Total factor productivity growth decomposition method

According to the DEA approach, there are two methods of decomposing TFP growth: the Malmquist index and the global Malmquist index. The thesis uses both of these indicators to decompose TFP growth for Vietnamese seafood processing industry.

2.2.3.1. Malmquist index

2.2.3.2. Global Malmquist index

2.3. Method of analyzing the impact of factors on technical efficiency and total factor productivity

To analyze the impact of factors on TE and TFP of Vietnamese seafood processing industry. The thesis uses the Tobit regression model, the POLS model, the FEM and REM models. These models are superior for panel data.

2.3.1. Tobit regression model

2.3.2. POLS, FEM, REM models

2.4. Data source, research variables, the research sample and descriptive statistics of variables in the research sample

2.4.1. Data sources

The data used to research TE and TFP of Vietnamese seafood processing industry are secondary data, taken from the annual firm census data set of the General Statistics Office (GSO). And Provincial Competitiveness Data (PCI) of the Vietnam Confederation of Commerce and Industry (VCCI). The thesis used data for 6 years, from 2015 to 2020.

2.4.2. Variables in the models

2.4.3. Research sample and descriptive statistics of variables in the research sample

Chapter 3:
CURRENT STATUS OF TECHNICAL EFFICIENCY AND TOTAL
FACTOR PRODUCTIVITY OF VIETNAMESE SEAFOOD
PROCESSING INDUSTRY IN THE PERIOD 2015 - 2020

In this chapter, the thesis analyzes the current state of production and business activities of Vietnamese seafood processing industry from 2015 to 2020. Then, based on the research data sample introduced in section 2.4 of the thesis estimate and analyze TE, TFP of Vietnamese seafood processing industry by DEA and semi-parametric models. At the same time, the thesis decomposes TFP growth by the Malmquist index and the Global Malmquist index models.

3.1. Current status of production and business activities of Vietnamese seafood processing industry in the period 2015 - 2020

3.1.1. Number and structure of firms in the industry

3.1.2. Current status of performance of firms

3.2. Current status of technical efficiency of Vietnamese seafood processing industry

TE estimation results of Vietnamese seafood processing industry in the period 2015-2020 are presented in Table 3.5. The distribution of TE shows that the average score of TE in this period is 73.3%, with room for TE in the industry is about 26.7%. This means that Vietnamese seafood processing industry can cut the inputs used by 26.7% and still produce the same output as currently. In addition, the average TE between years in this period has not increased or decreased much. The highest TE was recorded in 2020 (77.3%) and the lowest was in 2019 (71.7%). This shows that Vietnamese seafood processing industry has little TE improvement in the period 2015-2020. The average value of the standard error of TE is about 10.1%, showing that the gap in technical efficiency of firms in the industry is relatively low, and firms have relatively uniform operating efficiency. However, the standard error of TE increased in the years 2018-2020, and it is a sign of an increase in the performance gap between businesses in the industry.

3.3. Current status of total factor productivity in Vietnamese seafood processing industry in the period 2015-2020

3.3.1. Current status of partial productivity of Vietnamese seafood processing industry in the period 2015-2020

3.3.2 Analyze the current status of total factor productivity of Vietnamese seafood processing industry in the period 2015-2020

3.3.2.1. Estimate the production function and predict the contribution of total factor productivity to the output

The estimated coefficients of the production function are consistent with economic theory and have statistical significance at the 1% level. In which the elasticity coefficient of output according to labor (0.653) is much larger than the elasticity coefficient according to capital (0.381), this implies that Vietnamse seafood processing industry is still labor-intensive. The total elasticity of output by capital and labor is greater than one (0.653+0.381), showing that the performance of firms is currently increasing with scale. The prediction result of the average contribution of TFP to the output of Vietnamese seafood processing industry in the period 2015 - 2020 is 2.124, indicating that improving the efficiency of capital and labor use thanks to the impact of factors. Technological innovation, production rationalization, management improvement, labor qualifications... help the output of the industry increase by an average of 2.124 times in the period 2015 - 2020.

3.3.3.2. Decomposition of total factor productivity growth of Vietnamese seafood processing industry in the period 2015-2020

a) Decomposition of total factor productivity growth by the Malmquist index model

In this section, the thesis calculates the total factor productivity change (TFPC) of Vietnamese seafood processing industry over the years and decomposes it by components as technical efficiency change (TEC), technological change (TC), pure technical efficiency change (PEC), and scale efficiency change (SEC).

b) Decomposition of total factor productivity growth by the Global Malmquist index model

Decomposing TFP growth of Vietnamese seafood processing industry by the Malmquist index model is based on the traditional assumption that all firms in the industry have the same production technology in each period. However, this is not consistent with reality and may lead to biased estimates of productivity. The author divides firms of Vietnamese seafood processing industry in the period 2015 - 2020 into three groups by size as small firms, medium firms, and large firms, then estimates the production technology gap between the groups as well as estimates TFPC and its components.

(+2,9% TFPC) = (+ 1,3% TEC) x (-0,9% BPC) x (+2,5% TGC)

This decomposition results shows that TFP growth of the industry averages 2.9% per year. The main contribution to this growth is the narrowing of the technology gap between firms (TGC) and greater optimization of inputs of the production process (TEC). However, delays in innovation and technological improvement (BPC) are the cause of hindering total factor productivity growth of Vietnamese seafood processing industry today.

Chapter 4:
ANALYZING THE IMPACT OF FACTORS ON TECHNICAL EFFICIENCY AND TOTAL FACTOR PRODUCTIVITY OF VIETNAMESE SEAFOOD PROCESSING INDUSTRY

With the estimation results on TE in section 3.2 and TFP in section 3.3.2.1, along with the theoretical basis in section 2.3, in this chapter the thesis will build and estimate the impact of factors on TE and TFP of Vietnamese seafood processing industry.

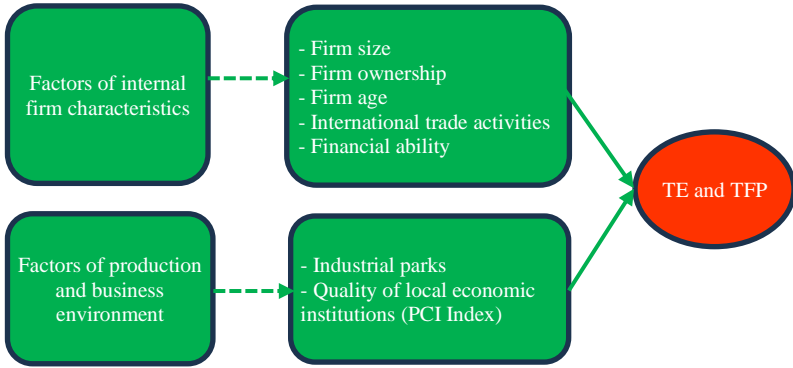## 4.1. Research model and research hypotheses

4.1.1. Build the models

Figure 4.1: Model of factors affecting TE and TFP of Vietnamese seafood processing industry

4.1.2. Specific models and research hypotheses

4.1.2.1. Specific models

With the above arguments, as well as inheriting the experimental research models analyzed in sections 1.2.1 and 1.2.2. The author proposes models of factors affecting TE and TFP of Vietnamese seafood processing industry in the period 2015-2020 following.

$$TE_{it} = \beta_0 + \beta_1 Ex_{it} + \beta_2 \ln K_{it} + \beta_3 \ln Age_{it} + \beta_4 Debt_{it} + \beta_5 Ownership_{it} + \beta_6 Zone_{it} + \beta_7 \ln Pci_{it} + \varepsilon_{it}$$

(4.1)

$$TFP_{it} = \beta_0 + \beta_1 Ex_{it} + \beta_2 \ln K_{it} + \beta_3 \ln Age_{it} + \beta_4 Debt_{it} + \beta_4 Ownership_{it} + \beta_6 Zone_{it} + \beta_7 \ln Pci_{it} + \varepsilon_{it}$$

(4.2)

4.1.2.2. Hypotheses about the direction of impact of variables in the models

4.2. Estimated results

4.2.1. Descriptive statistics of variables

4.2.2. Test the suitability and select the estimation method of the models

4.2.3. Analyze estimation results

For the group of factors belonging to internal firm characteristics, the results show that: The regression coefficient of the *Ex* in both models is positive and statistically significant, showing that import-export activities have a positive impact; The regression coefficient of the *lnK* shows different impacts between the two models. Specifically, the firm size has a positive impact on TE but has a negative impact on TFP; The coefficient of the *lnAge* variable in the two models is also positive and statistically significant at the 1% level. This supports the hypothesis of learning by doing on performance and productivity of firms; The regression coefficient of the financial constraints variable (*Debt*) is negative and highly statistically significant in both models, implying that when outstanding debt on equity increases by 1%, the TE and TFP decrease -0.015% and -0.048% respectively; Finally, the regression coefficient of the firm ownership variable (*Ownership*) shows the negative impact of state ownership on the efficiency and productivity of the seafood processing industry.

For the group of factors of production and business environment, the results show that: The coefficients of the *Zone* are all positive and statistically significant at the 1% level, implying the positive impact of the industrial park on TE and TFP of Vietnamese seafood processing industry; The regression coefficient of the *Pci* shows that there is a positive impact of institutional quality and business environment on the efficiency and productivity of Vietnamese seafood processing firms.

Chapter 5:
SOME SOLUTIONS TO IMPROVE TECHNICAL EFFICIENCY AND TOTAL FACTOR PRODUCTIVITY OF THE VIETNAMESE SEAFOOD PROCESSING INDUSTRY

In this chapter, the thesis analyzes the context, orientation and development goals of Vietnamese seafood processing industry. From the research results, the thesis suggests recommendations and proposes some solutions to improve TE and TFP of Vietnamese seafood processing industry.

5.1. Orientations and goals for Vietnamese seafood processing industry to 2030 with a vision to 2045

5.1.1. Issues facing Vietnamese seafood processing industry

5.1.2. Orientations

5.1.3. The goals of the seafood processing industry to 2030 with a vision to 2045

Develop the seafood processing industry into a high-quality and value-added production sector, helping to increase labor income and contribute to the national economic growth; Ensure that Vietnamese seafood processing products comply with international food safety and quality standards, in order to seize export opportunities in the international market; Promote the protection and sustainable management of marine fisheries resources to ensure future seafood supplies; Invest in research and development to improve product processes, reduce waste and increase productivity; Create job opportunities for people and improve working conditions, ensuring labor safety. Specifically, the average growth rate of processed seafood output during this period reached over 6%/year. The proportion of export value of value-added processed aquatic products averages over 40% (In which: shrimp reaches 60%, pangasius reaches 10%, tuna reaches 70%, squid and octopus reaches 30%, other aquatic products reached 30%). Over 70% of export seafood processing establishments have achieved average production level and technological capacity of advanced medium or higher. Form some modern seafood processing corporations and firms, with economic potential and management level on par with the world. The value of seafood processing for domestic consumption reached 40,000-45,000 billion VND. Contributing to the value of seafood export turnover reaching about 14 - 16 billion USD.

5.2. Some solutions to improve technical efficiency and total factor productivity in Vietnamese seafood processing industry

Based on the estimated results from experimental models on TE and TFP of Vietnamese seafood processing industry in the period 2015 - 2020. The thesis proposes some recommendations and solutions to improve TE , TFP of the seafood processing industry, aiming to make Vietnam a seafood processing center ranked among the top 5 countries in the world.

5.2.1. Solutions for firms in the Vietnamese seafood processing industry

5.2.2. Solutions for the Vietnam Association of Seafood Exporters and Producers

5.2.3. Solutions for state management agencies

CONCLUSION

1. Conclusion

The thesis has reviewed the theoretical basis of technical efficiency and total factor productivity, analyzed the current state of development, efficiency and productivity of Vietnamese seafood processing industry. From there, the author estimates the technical efficiency score, contribution of TFP to output and decomposes TFP growth for the industry. The thesis used a semi-parametric model to estimate the contribution of TFP, a DEA model to estimate TE and decompose TFP. Furthermore, the thesis also uses the Global Malmquist index model to have more accurate analysis of TFP growth. Thereby, the thesis has predicted the TE score and the contribution of TFP to output as well as the TFP growth of Vietnamese seafood processing industry in the period 2015-2020. In addition, the thesis has focused on clarifying the influence some factors on technical efficiency and total factor productivity of the industry. This means promoting the contribution of factors that are internal firm characteristics as well as efforts to improve the production environment and the quality of economic institutions to create favorable conditions for the industry to reach high productivity. The results of estimation and analysis from research models show that:

The TE score is still low, the average is only 73.3%, meaning that Vietnamese seafood processing industry can cut inputs used by 26.7% and still produce the outputs. The average contribution of TFP to the industry outputs is 2.124, which means improving the efficiency of capital and labor use based on the impact of technological innovation, production rationalization, management improvement, and improvement of worker qualifications... make the outputs increase an average of 2,124 times. Decomposing the TFP growth by the Malmquist index model shows that TFP growth averages 2.0% per year. Contribution to this growth was due to the

contribution of technical efficiency change (TEC) and technological change (TC) with the same average rate of 1.0%. Meanwhile, the TFP growth rate averaged 2.9% per year by the Global Malmquist index model. And it is mainly contributed by the 2.5% rate of technology gap change (TGC) and 1.3% of technical efficiency change (TEC). However, the average decline in the rate of best practice change (BPC) is -0.9%, which is the reason that inhibits the TFP growth. Furthermore, the analysis results also show that the biggest bottleneck in efficiency and productivity of the industry today is the small firms sector and the state-owned firms sector.

Besides, the thesis has shown the impact of internal firm characteristics as well as objective factors on TFP of the industry during the research period. In particular, internal firm characteristics such as export activities and the firm age have a positive impact on both TE and TFP. But the ratio of outstanding debt to equity and the state ownership have a negative impact on both TE and TFP. In addition, the firm size has a positive impact on TE but a negative impact on TFP. In addition, production environment factors such as firms located in industrial parks and the quality of economic institutions and business environment in provinces also promote the growth of both TE and TFP of the industry.

The findings of the thesis are an important scientific basis that requires the Vietnamese seafood processing industry to be more active in optimizing existing inputs and innovating production technology. At the same time, it is necessary to narrow the technology gap between firms sectors by size and ownership. In addition, local governments need to be determined and make more efforts in developing infrastructure of industrial parks, improving the business environment to create conditions for improving efficiency and productivity of the industry. That is the driving force for economic development, innovating growth quality and ensuring sustainable development for Vietnamese seafood processing industry in the coming time.

2. Limitations of the thesis and future research directions

In addition to the remarkable results achieved, the author finds that the thesis still has some limitations following:

Technically, in estimating TE, TFP levels and decomposition TFP growth, the thesis applies DEA method, Malmquist index model

and Global Malmquist index. The disadvantage of these techniques is that they are not statistically inferential and can be influenced by dominant observations. Besides, in the estimation of the contribution of TFP to output the thesis only applies the semi-parametric method of Wooldridge (2009) without applying the improved estimation procedures of Mollisi & Rovigatti (2018) based on the dynamic panel tool matrixes. This approach increases the moment limits without losing information, which is highly desirable when doing empirical estimation with panel data sets with a large number of observations but a short period of time.

Besides, the thesis still has limitations in terms of data, so some important factors such as R&D, competitive intensity, qualifications of labor, technology spillovers, which can impact TE and TFP of the industry but have not been included in the empirical analysis models. Therefore, there has not been a comprehensive assessment of the factors that determine the TE and TFP levels.

To overcome the above limitations, in the future the thesis needs to apply the Boostrap technique in sample analysis to eliminate the influence of dominant observations. Besides, the thesis can apply some approaches to parametric stochastic frontier analysis or new semi-parametric stochastic frontier analysis (Colombi et al., 2014; Kumbhakar et al., 2014; Sickles and Zelenyuk, 2019; Sickles et al., 2020; Badunenko et al., 2021; Simar et al., 2017) to estimate TE and TFP and have statistical tests for the results. In addition, the thesis needs to include additional factors in building and analyzing the model of factors affecting TE and TFP of the industry. The thesis can be built and estimated using dynamic models to consider the impact of the past efficiency and productivity on the current efficiency and productivity.

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