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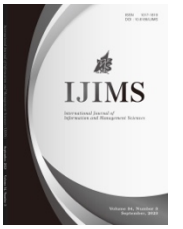

What are Key Determinants of Productivities and Business Efficiency? The Case Study on Food Industry of Vietnam

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Keywords

Total factor productivity (TFP); Business environment; Vietnam transition economy

Abstract

This study employs the Quantile Regression model to examine the factors that contribute to Total Factor Productivity (TFP) in the food industry of Vietnam. The analysis is based on a survey conducted by the General Statistics Office of Vietnam (GSO) from 2011 to 2018, encompassing 14,515 observations from firms operating in the food industry. The empirical findings reveal the following: (i) Changes in scale efficiency and technological progress have a significant impact on the growth of TFP in the food industry; (ii) The business environment plays a favorable and influential role in TFP growth in this sector; (iii) Of the three types, the private sector has the greatest influence on all quartiles. Consequently, it is recommended that promoting international investment, adopting technology, and fostering a fair business environment are essential factors for strengthening competitiveness and improving productivity, as indicated by its decomposition.

1. Introduction

Total Factor Productivity (TFP) is a crucial measure of the operational or economic efficiency of enterprises. While initially applied in macro-level analysis, the concept of TFP is now commonly used in micro-level analysis, particularly within industries or individual firms (Thanh & Thuy, 2022). TFP serves as a significant indicator for evaluating the performance of enterprises and the overall economy. It enables the achievement of greater output with the same input through technological innovations (Ha, 2021). TFP growth acts as an internal driving force for enhancing the competitiveness of both enterprises and countries in the market. By utilizing the TFP metric, businesses can determine the optimal capital structure and make informed decisions regarding the efficient utilization of input resources. Consequently, enterprises

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can make choices regarding capital structure, labor standards, and the adoption of technological advancements.

The food industry in Vietnam holds significant importance, boasting a large number of enterprises, ranking second in pre-tax profit and fourth in job creation among the manufacturing and processing industries in 2020. Vietnam has emerged as one of the most attractive markets globally for the Food and Beverage (F&B) sector, as recognized by market research firm BMI. This sector contributed 15.8% to the nation's total GDP in 2021, with food and beverage spending accounting for approximately 35% of total expenditure. Despite its economic contributions, the food industry's growth strategy in Vietnam has heavily relied on input accumulation, primarily focused on increasing labor and capital quantities. While this strategy is suitable when inputs are abundant and inexpensive, for Vietnam to achieve higher levels of development, it needs to shift its growth strategy towards enhancing the efficiency of capital and labor utilization, ultimately improving Total Factor Productivity (TFP). The food industry plays a crucial role in the growth and development of transitional economies due to its job creation potential and interconnections with other sectors. Therefore, it is imperative to gain a comprehensive understanding of productivity dynamics in a developing economy.

This paper seeks to enhance the analysis of factors influencing TFP in the food industry, building upon the research of Koenker (2005), Hao and Naiman (2007). By utilizing quantitative techniques and enterprise survey data, we explore the growth components of TFP and identify external influences on TFP within the food industry. Our findings provide valuable insights for policymakers and businesses, shedding light on key indicators such as institutions, governance, financial development, and macroeconomic stability, which serve as driving forces behind TFP. This information aids policymakers in understanding the nature of profitability in the production process and supports informed decision-making for the country's development.

2. Literature Review

According to Sten (1953) identified four components that determine TFP growth: technical efficiency change index (effch), technological progress change index (techch), pure efficiency change index (pech), and scale efficient change (sech). Similarly, Kumbhakar et al (2005) divided TFP growth into three components: technical change (te), technical efficiency change (tec), and scale change (sc). Decomposing TFP into these components provides policymakers with valuable insights for enhancing productivity. Understanding the sources of productivity growth allows policymakers to recommend more effective policies for improving firm productivity. The Malmquist index is a useful tool for analyzing the dynamics of TFP growth, examining the rise in efficiency components such as effch, techch, pech, and sech. The Data Envelope Analysis (DEA) method, utilizing the Malmquist index, has been widely employed in recent research. For instance, Pokhare et al (2019) evaluated the effectiveness of agricultural cooperation in the US, while Fathi and Saen (2021) and Liu et al (2021) analyzed the efficiency of supply chains in various industries using the Malmquist index.

TFP growth offers valuable insights to policymakers, providing a comprehensive view of the sources of economic growth (Kim & Han, 2000). Feng et al (2018) highlight the extensive use of TFP studies to evaluate productivity and business efficiency at various levels. Studies on TFP can be classified into two groups: (i) those using the traditional TFP index with factors such as capital, labor, total added value, and profits (Li et al, 2021; Santos et al, 2021; Nakatani, 2021); and (ii) those incorporating environmental factors in the green TFP index (Yang et al, 2021; Emrouznejad & Yang, 2018). In the agriculture sector, Liang et al (2017) and Chambers

& Pieralli (2020) find that climate change affects agricultural productivity directly and indirectly. Li et al (2021) examine the impact of economic policy uncertainty (EPU) on firm TFP in China, revealing a significant negative effect on enterprises, particularly non-state and large-scale enterprises. Nakatani (2021) assesses the influence of financial leverage and intangible assets on TFP growth in the information and communication technology sector across industrialized nations. Intangible assets and financial leverage have a greater impact on TFP for manufacturing companies compared to information and communication technology service companies. FuKao et al (2005) discover that foreign companies acquire Japanese businesses with higher TFP levels and better profit rates, whereas domestic mergers and acquisitions often involve rescuing small businesses with higher total obligation-to-asset ratios.

Numerous researchers have examined the factors influencing TFP growth at the enterprise level. Understanding these factors helps businesses make informed investment decisions to enhance output and contribute to overall economic growth (Roberts & Tybout, 1997; Bernard & Jensen, 2004; Yao et al, 2021; Dut et al, 2017). Governments can support productivity improvement by considering the factors influencing TFP growth, ensuring stability, competitiveness, and the well-being of employees (Ha, 2021; Hung at el, 2013). Ownership, financial constraints, institutions, and leverage costs have been analyzed by (Cull et al, 2015) and (Zhang et al, 2017) to explain the relationship between TFP and leverage. R&D investment, education, innovation, technology transfer, and human capital are found to be significant determinants of TFP growth in studies by Wang and Tsai (2003), Cameron et al (1999), Griffith et al (2000) and Mayer (2001). Domestic R&D spending is particularly important for TFP growth in developing countries, according to Herzer (2022). The impact of environmental factors, such as changes in natural capital, on productivity is explored by Olewiler (2002). Peng et al (2021) examine the impact of a policy reform in China on TFP and find that it positively affects manufacturing firms' productivity through forward and backward linkages along the value chain. Firms are advised to capitalize on this opportunity by focusing on core businesses and increasing external R&D purchases to enhance productivity.

3. Method

The quantile regression method, introduced by Koenker & Bassett (1978), offers an alternative approach to estimating regression parameters. Rather than focusing on estimating parameters for the mean regression function using OLS, quantile regression estimates regression parameters at different quantiles of the dependent variable. This allows for the determination of the marginal effect of the independent variable on the dependent variable at each quantile, rather than just the mean. The aim is to minimize the sum of absolute differences between the regression function and the quantiles of the dependent variable.

Following the introduction of quantile regression by Koenker & Bassett (1978), Taylor (2000) developed the quantile regression neural network (QRNN). Unlike traditional approaches, QRNN allows for flexible modeling of nonlinear relationships between the response and covariates without the need to specify an exact functional form. This method has found applications in forestry research, such as self-thinning boundary lines, diameter growth (Bohora & Cao, 2014), tree taper (Cao & Wang, 2015), and crown modeling (Sun et al, 2017), etc.

Koenker & Bassett (1978) proposed the method of quantile regression (QR-Quantile Regression). View the following model:

$$\boldsymbol{Y_i} = \boldsymbol{x_I}' \, \boldsymbol{\beta_\sigma} + \boldsymbol{u_{i\sigma}} \quad (3.1)$$

Quantileơ (yi | xi) = inf{y : Fi(y |x) Ơ} = x β (3.2) Assumption: Quantileơ ($u_{iơ}$ |x_i) = 0

Where: Quantileơ (y_i | x_i) is quantile regression Ơth ∈ (0;1) of the dependent variable y_i , $\alpha_ơ$, $\beta_ơ$ the estimated parameter vector, $u_{ơi}$ is the error component, F_i (y|x) is the probability distribution function of y in the condition that x and $f_{uơ}$ (y |x) is a Probability density function. Change Ơth ∈ (0;1) will reflect the entire distribution of the variable yi . Estimating the parameters $\alpha_ơ$,$\beta_ơ$ based on the following conditions:

$$\text{Min } \sum_{i:u_{ơi}>0} Ơ \times |u_{ơi}| + \sum_{i:u_{ơi}<0}(1-Ơ) \times |u_{ơi}| \quad (3.3)$$

$$\text{Min}\sum_{i:\, y_i - x'_i\beta>0} Ơ \times |y_i - x'_i\beta_ơ| + \sum_{i:\, y_i - x'_i\beta<0}(1-Ơ) \times |y_i - x'_i\beta_ơ| \quad (3.4)$$

Quantile regression has advantages over Ordinary Least Squares (OLS) and Least Absolute Deviation (LAD) regression, QR allows the researcher to review the full variation of y_i based on the change of Ơth ∈ (0;1) . On the other hand, according to Hao and Naiman [26], the assumption in QR is not so strict as OLS and LAD. For example, the condition of normal distribution and homoskedastic is not necessary.

4. Data

This study utilizes a dataset obtained from an enterprise survey conducted by the General Statistics Office of Vietnam spanning from 2011 to 2018. The General Statistics Office operates under the Ministry of Planning and Investment and plays a crucial role in advising and assisting the ministry in statistical management. It coordinates and conducts various statistical activities and provides socio-economic statistical information in accordance with the law. The office is responsible for conducting a significant portion of the National Statistical Survey Program, accounting for nearly 70% of the surveys conducted annually. In addition to the program, the office also carries out surveys outside of it to meet the statistical data requirements at the local level. Data collection methods employed by the office include statistical investigations, periodical statistical reporting, and extraction of data from administrative records. Statistical investigation remains the primary method for collecting input data for statistical purposes.

This paper focuses on the food processing industry, specifically at the sector code level 2:10. After excluding enterprises with missing data, the sample consists of 14,515 observations. These observations are further classified by the type of enterprise: state-owned enterprises (288 observations), private enterprises (10,501 observations), foreign enterprises (2,677 observations), and cooperatives (1,049 observations). Additionally, the sample is categorized by business size, with micro-enterprises accounting for 64.19% of the sample, followed by small enterprises (14.58%), medium enterprises (3.3%), and large enterprises (17.93%).

Table 1: *Summary and statistics of variables*

Variables	Number of enterprises	Medium	Standard deviation	Smallest value	Greatest value
The Food industry					
LnL (Labor)	145155	3.31	1.59	-0.69	9.27
LnK (Capital)	145155	9.43	2.09	1.10	17.23
LnC (Cost of goods)	145155	9.45	2.66	-1.20	17.02
Ln VA (Value added)	145155	5.19	2.64	-2.30	16.17

The input variables used in the regression models are labor, assets (calculated based on the average of data at the beginning and end of the year), and cost of goods sold. The output variable is the after-tax profit of the enterprise. Additionally, the regression models include explanatory variables that represent the firm's size, exports, imports, and type of ownership. These variables are included to provide further insights and explanations in the analysis. In addition, each model has an independent variable "PCI" to control for the external business environment. The independent variable included is the provincial competitiveness index PCI: lnPCI. The independent variables included in a model are: type of business (i_Type), export (Export), imports (Imports), assets (LnK) and labor (LnL). Control variables include the proportion of fixed assets (FA), financial leverage (FL), payable corporate income tax (Tax), age of enterprise (lnAge), Industrial zone (Zone).

Total Factor Productivity

TFP is reflecting the production results due to the upgraded efficiency in capital and labor use, thanks to the innovation in technology, rationalization in production improvement in management, and improvement of labour qualification. The input components are best coordinated to optimize labor and capital, as well as to enhance technical processes and management. TFP is calculated as follows:

$$\ln Y = ln\, A + \alpha ln\, K + \beta ln\, L$$

In which, Y is the output, K is the amount of capital input, L is long-term and short-term labor input, A is the aggregate productivity, $\alpha \& \beta$ are the coefficient of elasticity according to the sales of capital and labor respectively.

Labor and capital

The input factors of "labor" and "capital" play significant roles in influencing production costs, productivity, and business efficiency. Research by Quan et al (2022), Dut et al (2017), Khanh (2019), Li et al (2021), Santos et at (2021) and Nakatani (2021) has shown that both capital and labor make a contribution to the growth of four agricultural sectors.

Value added

“Value added” measures the output of an enterprise, reflects new value of the production of goods and services, which is the basis for enterprises to carry out extended reproduction to improve business efficiency. The study of Peng et al (2021), Quan et al (2022) and Cao & Hoang (2020) also relied on “added value” to evaluate the productivity as well as the output quality of enterprises.

Type of Business

In this study, the "type of business" refers to the different forms that individuals and organizations choose to conduct their business activities and represents their business goals. The specific types of enterprises considered in this study include cooperatives, foreign enterprises, and private enterprises. There have been many domestic and foreign authors studying the relationship between foreign direct investment and productivity growth in enterprises such as Hung et al (2013), Newman et al (2015), Zhou et al (2002), Suyanto et al (2012) and Harris & Robinson (2003). All these studies show that foreign enterprises have higher productivity than domestic enterprises, especially FDI enterprises.

Business environment

In this study, the term "business environment" refers to the external environment in which the enterprise operates. It encompasses both the macro and micro environments, which present opportunities and challenges that can directly or indirectly impact the business activities of the enterprise. El-hadj Bah & Fang (2015) show that the business environment has a positive impact on output and productivity in African countries, the poor business environment causes businesses to lose most of their revenue, leading to a negative impact on the growth of Africa.

Others

Besides the above variables, the study also considers whether other variables such as import (Import), export (Export), proportion of fixed assets (FA), financial leverage (FL), corporate income tax payable (Tax), age of enterprises (lnAge), industrial zones (IZs) affect the productivity and business efficiency of enterprises or not.

5.Results

It can be seen, the value and growth rate of TFP in the food industry in Vietnam remain relatively low. Despite the availability of affordable human resources and accessible natural resources, Vietnamese food firms primarily focus on horizontal expansion. Although TFP in the food industry has shown some increase since 2013, it remains unstable and has not reached the benchmark required to match the rising labor productivity of other ASEAN nations.

Table 2: *Total factor productivity (TFP) of the food industry in Vietnam from 2011 to 2018*

year	Mean	Std. Err.	[95% Conf. Interval]	
2011	4.144	0.20056	3.75140	4.537651
2012	6.187	0.42892	5.34713	7.028556
2013	4.857	0.68695	3.51108	6.204035
2014	5.067	0.50096	4.08579	6.049612
2015	7.047	0.46654	6.13273	7.961659
2016	5.629	0.30081	5.03991	6.219117
2017	4.959	0.34383	4.28542	5.633304
2018	5.635	0.46113	4.73172	6.539439
2011-2018	5,441			
Growth rate 2011-2018	7,544%			

In Table 3, the calculation shows that techch = 1.147 > 1, sech = 1.032 > 1, which are the main drivers of increasing aggregate factor productivity during this period. This result is similar to the study published at Cao et al (2020), their results also showed a picture of TFP's contribution that is different between the two periods 2011-2014 and 2015-2017. Although TFP's contributions to output growth are low in both periods, the magnitudes of technological progress (techch) and changes in technical efficiency (effch) are different. In the early stages, technological progress is negative (-2.19%) and changes in technical efficiency are positive and at a low level

(0.9%). However, in the later stage, the technological progress is positive (16.89%), and the change in technical efficiency is negative (-17.21%). In general, in the studies, the efficiency of technological progress plays an important role in promoting the growth of TFP in the food industry in Vietnam.

Table 3: A*verage Malmquist Index of Vietnamese food industry enterprises*

	effch	**techch**	**pech**	**sech**	**tfpch**
2011-2012	1.005	1.031	0.947	1.062	1.036
2012-2013	0.998	0.983	1.007	0.990	0.981
2013-2014	0.973	1.055	0.931	1.046	1.027
2014-2015	1.024	0.995	1.054	0.975	1.019
2015-2016	0.964	0.999	0.943	1.026	0.964
2016-2017	0.984	0.976	0.991	0.992	0.960
2017-2018	0.922	1.991	0.809	1.139	1.635
Average 2011-2018	0.981429	1.147143	0.954571	1.032857	1.088857

In studying the determination of exogenous factors affecting TFP of the food industry in Vietnam, we employ a panel quantile regression model. Results are reported at different quantiles (from 10^{th} to 90^{th}) of (the dependent variable). In Table 4, we report the simultaneous quantile regression results, while we respectively report quantile regression with clustered data results and generalized quantile regression results are reported in Table 5. In all reported results, the variables remain the same. In Table 4 the simultaneous quantile regression results show that the coefficients of financial leverage (FL), age, industrial zone and tax are statistically significant and positive in the 25^{th} -90^{th} quantiles. However, in the 90^{th} quantiles, the coefficient of tax is negative but found to be statistically insignificant in the 10^{th}- 90^{th} quantiles. Fixed asset (FA) variables and PCI have a negative effect on the change of TFP, where PCI has a negative effect from the 50^{th} -90^{th}. The interesting point in table 5 is that at the 90^{th} quantile, most of the coefficients of the independent variables are not statistically significant, and at the 10^{th}, R^2=0.0000 shows the QR model with Export is a control variable that does not explain the change of factors to the change of TFP. As for another quantile, the interpretation of variables is also very weak.

Table 5 where enterprise import, R^2=0.0000 at the 10^{th} quantile as very small at the 25^{th} -90^{th}. The coefficients are not statistically significant at the 90^{th}. Fixed asset (FA) variables and PCI in general still have a negative influence to TFP. It can be seen that with the control of the business environment in Vietnam the variables being import and export the impact on TFP is not clear.

Table 6 shows an estimate of the entire variance-covariance of the estimators by bootstrapping with 100 bootstrap replications. The dummy variable is the type of business (Type), it can be seen that the PCI index is the most influential factor on TFP at the 10^{th} quantile and has a positive effect. However, it diminishes in the remaining quantiles. Similar to PCI, the variables of fixed assets (FA), capital structure or financial leverage (FL), and firm age (Age) decrease in the last quantiles and have a negative influence. This is especially because we expect that among different types of enterprises, the type of private sector is the one that has the strongest impact on TFP in all 5 quantiles (0.1; 0.25; 0.5 ; 0.75; 0.9), followed by the type of FDI and finally the cooperative. The commonality of these three types of enterprises is at the

90^{th}, they all tend to decrease slightly compared to the 75^{th} and most of them have p<0.01 significance level. In this model, R^2 at the 75^{th} quantile is the highest with R^2= 25.39%.

Therefore, in panel data of 14515 observations of food industry enterprises in Vietnam, the quantile regression model with type of enterprises as the control variable shows more clearly than other models the impact of exogenous variables (other than labor, cost of goods, and assets - these are factors that directly affect TFP). According to the findings presented in Table 6, this analysis indicates that the PCI (Private Credit Index) has a consistently positive and significant impact across various percentiles. This aligns with our expectations regarding Vietnam's recent efforts to enhance its environmental conditions and competitiveness. In comparison to other sectors, the private sector has emerged as the leading contributor to the changes observed in Vietnam's TFP (Total Factor Productivity) index.

Table 4: *Quantile regression model where enterprises exports*

Factors	**Export**				
	q10 (1)	**q25 (2)**	**q50 (3)**	**q75 (4)**	**q90 (5)**
Fixed assets (FA)	-0.000	-0.015***	-0.017***	-0.003	0.001
	(0.000)	(0.002)	(0.005)	(0.007)	(0.012)
Financial leverage (FL)	0.000	0.008***	0.016***	0.011***	0.000
	(0.000)	(0.003)	(0.005)	(0.004)	(0.006)
Age	0.000	0.010***	0.010***	0.000	0.001
	(0.000)	(0.001)	(0.003)	(0.002)	(0.004)
Tax	0.000	0.009	0.015	0.002	-0.011
	(0.000)	(0.095)	(0.020)	(0.043)	(0.141)
Zone	(0.074)	0.008***	0.016***	0.011***	0.007
	(0.000)	(0.001)	(0.004)	(0.004)	(0.007)
PCI	0.000	0.029**	-0.266***	-0.585***	-0.938***
	(0.000)	(0.015)	(0.042)	(0.026)	(0.156)
Constant	1.422***	1.448***	2.693***	4.141***	5.677***
	(0.000)	(0.058)	(0.169)	(0.106)	(0.644)
observes	14515	14515	14515	14515	14515
PseudoR2	0.0000	0.0088	0.0119	0.0302	0.0579
Simultaneous quantile regression bootstrap(100) SEs Standard errors in parentheses * p<.1, ** p<.05, *** p<.01					

Table 5: *Quantile regression model where enterprise import*

Factors	**Import**				
	q10 (1)	**q25 (2)**	**q50 (3)**	**q75 (4)**	**q90 (5)**
Fixed assets (FA)	-0.000	-0.014**	-0.009***	0.001	0.000
	(0.000)	(0.002)	(0.003)	(0.007)	(0.012)
Financial leverage (FL)	0.000	0.007***	0.008**	0.015***	0.000
	(0.000)	(0.002)	(0.003)	(0.004)	(0.006)
Age	0.000	0.010***	0.007***	0.000	0.000
	(0.000)	(0.001)	(0.002)	(0.002)	(0.003)
Tax	0.000	0.010	0.015*	0.002	-0.010
	(0.000)	(0.094)	(0.009)	(0.02)	(0.047)
Zone	(0.074)	0.005***	0.008***	0.007	0.000
	(0.000)	(0.001)	(0.003)	(0.004)	(0.005)
PCI	0.000	0.041***	-0.227***	-0.595***	-0.931***
	(0.000)	(0.010)	(0.030)	(0.020)	(0.171)
Constant	1.422***	1.399***	2.536***	4.182***	5.654***
	(0.000)	(0.039)	(0.122)	(0.080)	(0.702)
Observes	14515	14515	14515	14515	14515
PseudoR2	0.0000	0.0077	0.0100	0.0277	0.0582
Simultaneous quantile regression bootstrap(100) SEs Standard errors in parentheses * p<.1, ** p<.05, *** p<.01					

Table 6: *Quantile regression model where the type of business is the dummy variable.*

Factors	Type				
	q10 (1)	**q25 (2)**	**q50 (3)**	**q75 (4)**	**q90 (5)**
Cooperative	0.170*	0.217***	0.387***	0.414***	0.376***
	(0.099)	(0.080)	(0.057)	(0.057)	(0.080)
Foreign	0.866***	0.925***	1.251***	1.288***	1.217***
	(0.124)	(0.101)	(0.072)	(0.076)	(0.104)
Private	1.541***	1.827***	2.157***	2.199***	2.090***
	(0.113)	(0.092)	(0.077)	(0.067)	(0.084)
Fixed assets (FA)	0.032	-0.081	-0.203***	-0.340***	-0.289***
	(0.167)	(0.115)	(0.070)	(0.077)	(0.085)
Financial leverage (FL)	-1.070***	-0.938***	-0.738***	-0.567***	-0.254
	(0.147)	(0.197)	(0.174)	(0.173)	(0.216)
Age	0.049	0.037	-0.004	-0.081***	-0.153***
	(0.050)	(0.042)	(0.034)	(0.030)	(0.034)
Tax	0.747	36.146	56.730***	54.482***	42.727***
	(21.717)	(26.274)	(17.461)	(11.275)	(8.395)
Zone	0.641***	0.758***	0.714***	0.835***	0.763***
	(0.101)	(0.082)	(0.068)	(0.048)	(0.048)
PCI	2.291***	2.189***	1.896***	1.227***	0.010
	(0.468)	(0.371)	(0.262)	(0.342)	(0.255)
Constant	-11.525***	-10.330***	-8.425***	-4.724***	1.220
	(1.903)	(1.486)	(1.094)	(1.430)	(1.053)
Observes	14515	14515	14515	14515	14515
PseudoR2	0.0663	0.1182	0.2029	0.2539	0.2479
Simultaneous quantile regression bootstrap(100) SEs Standard errors in parentheses * p<.1, ** p<.05, *** p<.01					

6.Discussion

Based on our research, we have found that the total factor productivity (TFP) of the Vietnamese food industry remains relatively low, with a value of only 5,441 and a growth rate of 7.5% during the period of 2011-2018. The World Bank and The Conference Board have identified three main factors that contribute to the stagnation of TFP growth: (i) Insufficient and inaccurate measurement of the contribution of information technology and digital goods and services; (ii) Difficulty in measuring important factors such as market power, labor quality, entrepreneurship, and intangible assets, which are crucial in calculating TFP; (iii) The implementation of new technologies often incurs high initial investment costs, which can temporarily reduce productivity. Additionally, the impact of many technologies may take 1-2 decades to fully manifest. These issues highlight the challenges faced in accurately assessing and improving TFP in the Vietnamese food industry.

Among the four components that affect TFP growth, the change in scale efficiency contributes 3.2%, while technological progress contributes 14.7% to the growth of TFP in Vietnam's food industry. Similar findings were observed in another study conducted by Minh & Long (2010), where they utilized the stochastic marginal method to decompose TFP growth in Vietnam's manufacturing industries during the period 2001-2007, with technological progress playing a significant role. In contrast, a study by Cao & Hoang (2020) estimated the contribution of these factors to the TFP growth specifically in the food processing and beverage manufacturing industry in Vietnam from 2011 to 2017. Their research results indicate that the contribution of TFP to output growth is primarily driven by technical progress, while the contribution of efficiency change due to size and distribution has an insignificant impact.

Currently, the business environment, represented by the PCI (Private Credit Index), is identified as a crucial external factor influencing the TFP growth of the food industry in Vietnam. Efforts to enhance the business environment and improve competitiveness not only aim to increase social labor productivity but also focus on enhancing capital efficiency and overall TFP. The findings align with a study conducted by Anh & Hung (2013), which analyzed the impact of institutions, the business environment, and corporate governance on the productivity and performance of Vietnamese enterprises during the period 2006-2012. Through panel data regression with fixed effects, their study revealed that improvements in the business environment positively contribute to business performance. Therefore, our findings in the context of the food industry reinforce the importance of implementing policies aimed at enhancing the quality of the business environment to boost the productivity and performance of Vietnamese enterprises in the present timeframe.

In the past decade, the private sector in Vietnam has made significant progress, contributing to the overall socio-economic development. This sector has also played a crucial role in improving Vietnam's TFP value in recent years. Our findings demonstrate that the private sector within the food industry has the greatest impact across all quartiles. Notably, the influence of private enterprises on TFP growth is particularly significant in the upper percentiles (10%, 25%, 50%, 75%, 90%). This suggests that enhancing competitiveness through promoting international investment and establishing a fair business environment are vital factors in boosting the productivity of private enterprises.

7.Conclusion

This study utilizes a dataset obtained from an enterprise survey conducted by the General Statistics Office of Vietnam between 2011 and 2018. The dataset comprises 14,515 observations from the food industry. Quantile regression is employed to analyze the exogenous factors that affect the TFP of Vietnam's food industry. Several noteworthy findings from the analysis include: (i) The Vietnamese food industry's TFP is still growing at a very slow rate and has a very low value. (ii) Changes in TFP in the food industry in terms of composition, changes in scale efficiency, and technological progress are driving forces for TFP growth. (iii) Business environment and competitiveness have a positive impact and greatly influence the change of TFP in the food industry. (iv) The private sector has the largest impact on all quartiles of the three types, where the type of state-owned enterprises is the base variable.

To improve labor productivity and total factor productivity (TFP) of the food industry in Vietnam, policy recommendations based on our findings as follows: (i) reforms and enhance business environment, especially the 4.0 Competitiveness Index (WEF) and Provincial Competitiveness Index (PCI); (ii) Encourage and facilitate private sector to fully participate into the value chain of the food industry both domestically and internationally, and reducing the monopoly of state-owned enterprises; iii) last but not least, promote international trade apparel with fully integrate into international law in order to merge Vietnam into the world trade and investment institution.

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