VILNIUS TECH
Vilnius Gediminas Technical University

Business: Theory and Practice
ISSN 1648-0627 / eISSN 1822-4202
2022 Volume 23 Issue 2: 435–444
https://doi.org/10.3846/btp.2022.15885

DETERMINANTS OF TFP IN THE FISHERIES SECTOR OF 28 COASTAL PROVINCES IN VIETNAM

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Received 4 November 2021; accepted 2 September 2022

Abstract. This study uses annual data of The Enterprise Survey and Provincial Competitiveness Index to analyze determinants of TFP of the fisheries sector and fishery firms in 28 coastal provinces of Vietnam. The paper evaluated the effects of different institutional variables on TFP at the firm level. In addition, impacts of macro variables on sector's TFP were also analyzed using sector aggregated TFP. Analyses of the study show that the industry's macro environment and firm characteristics significantly affect the fisheries sector's productivity. At the macro level, the more transparent the environment is, the higher the TFP. Thus, it is suggested that the local authorities of the coastal provinces of Vietnam need to speed up their reforms in administrative procedures, creating a favorable business environment for firms. At the micro-level, the variable of firm size is positively correlated with the TFP in the fisheries sector. The larger the size of the firm, the higher the productivity. In a labor-intensive industry such as fisheries, productivity increases with labor, indicating a low science and technology application level. To increase the sector's productivity, state support to expand the application of advanced technologies for domestic firms is essential.

Keywords: coastal provinces, fisheries, TFP, industry, firm.

JEL Classification: C23, D24, Q22, P42.

Introduction

The development of marine economics can absorb benefits from economic growth and suitable policies from management will vice Versace help coastal economy. For example, according to (Wang & Walden, 2021), fishing vessel productivity is an essential metric in economic performance, and yields information about the financial impact of policy changes on fishing fleets. A new method is proposed to measure sector-wide commercial fishery total factor productivity (TFP) and is applied using northeastern United States fishery-level data from 2007 to 2018. Quality differences embodied in the capital assets are accounted for and the TFP measurement is adjusted for fishery stock changes. Results show that for most fisheries, improvements in biomass after re-authorization of the new law led to improved TFP. This highlights the policies from managers if they understand the impact when they promulgate so that more effectiveness will come into effect. Another case is from the situation of China in which (Wang et al., 2021) systematically sort out the real-life logic of financial influence on marine productivity improvement and empirically test it using panel data from 11 coastal regions in China from 2006 to 2016. The findings show that the level of financial development significantly contributes to increased productivity in the marine industry. Furthermore, the regional heterogeneity analysis shows that the financial development of the eastern and southern marine economic circles has a more significant positive impact on the improvement of industrial efficiency. Further research also figures out that the depth, efficiency, and environment of financial development have a positive effect on the efficiency of the industry, mainly in the current coastal areas, and that the breadth of financial development has not yet had an effect.

Surely there is a positive relationship between marine economics and employment. According to Teh and Sumaila (2013), marine fisheries contribute to the global

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economy from catching fish through providing support services for the fishing industry. In total, the authors estimated that 260±6 million people are involved in global marine fisheries, encompassing full-time and part-time jobs in the direct and indirect sectors, with 22±0.45 million of those being small-scale fishers. This is equivalent to 203±34 million full-time equivalent jobs. The authors suggest that it is necessary to report and know the number of employees in this sector so that managers can deliver correct decisions. Also, regarding policies and employment, Li et al. (2021) confirm from 2005 to 2015, the within-growth effect caused by technological progress contributed approximately 92.74% to the labor productivity growth of China's marine economy, while the contribution of the structural shift effect was approximately 7.25%. China's marine economic policy regulated marine industrial structure and promoted scientific and technological progress through market-oriented incentives, industrial regulation constraints and support for technological innovation, etc. There is good synergy between the changes in policy and the change trend of the structural shift and within-growth effects in the labor productivity growth process of the marine economy and its three economic industries. It is likely to conclude that China's marine economic policies have an important impact on scientific and technological progress and industrial structure changes within the marine economy.

Total factor productivity (TFP) is considered the main driver of economic growth (Comin, 2010). TFP is a measure of productivity presented by the increase in total output that is not accounted for in the rise in total input. In other words, TFP is an indicator of the performance of any production system and sustainability of the growth process, the efficiency of technology (innovation), management, and the quality of exploited inputs in production (Syverson, 2011; Van Beveren, 2012). Since the research of Solow (1957), TFP has been considered an essential role in generating and predicting growth. TFP is defined as the portion of output that is not explained by the amount of input used in production. Its value represents the efficiency and intensity of the inputs used in production. Many studies using macro-level data have shown that differences in the growth patterns of countries are related to the differences in their manufacturing activities. However, measuring TFP at a macro level - country level often ignores the heterogeneity at the firm level.

With a coastal line of 3,260 km, spreading over 28 provinces, Vietnam has advantages in marine economy, especially in fisheries activities. In 2020, the fisheries sector contributed 4–5% to Vietnam's GDP and the total output of seafood in 2020 was 8.4 million tons, in which capture output was 3,85 million tons and aquaculture 4,56 million tons. The total export value of seafood in 2020 reached 8.5 billion USD. The labor force in this sector has been recruited with millions of people (Vietnam association of seafood exporters and producers, 2021). No thorough assessment of productivity in the fisheries sector has been conducted, taking the whole industry of agriculture, forestry and fishery into account, labor productivity in this level-1 sector is still low, perhaps the weakest in the entire economy's productivity. In recent years, both theoretical and empirical studies on TFP have made remarkable progress with the development of TFP estimation tools (Ackerberg et al., 2015) and the increasing availability of firm-level data allowing TFP estimation at the micro-level. With firm-level data, TFP can be calculated for the industry level. Consequently, this paper aims to investigate the productivity level of the fisheries sector in Vietnam via TFP and its determinants.

1. TFP determinants

Determinants of TFP at the macro level are grouped into four sets: (1) creation, transmission, and absorption of knowledge; (2) factor supply and efficient allocation; (3) institutions, integration, invariants (geography) and policy; (4) competition, social dimension, and environment (Isaksson, 2007). These determinants are often considered for TFP comparison across countries. At the micro-level, these determinants can be examined at the firm level (Saliola & Şeker, 2012). Productivity growth at the micro-level is the key to economic growth at the macro level in the long run (Giang et al., 2019). Therefore, the research of TFP determinants at the firm level can help identify the root of TFP in an economy.

Current literature has identified main determinants of TFP at the firm level, namely absorptive capacity, political affiliation, spatial spillovers and export activity. In empirical studies, absorptive capacity is proxied by R&D at the firm. R&D plays a dual role in firms since it can enable a firm to identify, absorb and exploit external knowledge for productive purposes. On the other hand, it generates products and process improvements within a firm. Thus, more spending on R&D will likely improve the TFP of firms. Spatial spillovers can be obtained in different ways based on a particular location (e.g., close to a big city), industrial relations, export activities, R&D activities, and FDI spillovers. All these closeness and connections can facilitate a firm to increase its productivity. For example, a firm will likely examine and imitate another firm's innovative and advanced technology if that technology will benefit them. Also, firms based near a big city or a center can reduce their input and output transportation costs. In exploring the cumulative effects of TFP, Combes et al. (2018) found evidence of higher TFP growth in larger French cities. The authors note that natural local advantages enhance the agglomeration of economies. They also cite the self-selection of enterprises in the fierce competition of large cities as the reason for higher productivity in these urban areas.

Firms that are politically affiliated can enjoy advantages over non-politically affiliated ones via access to credit, for instance (Johnson & Mitton, 2003). Political affiliation also helps a firm to benefit from government contracts. Research in the United States among companies with connections to winning parties during an election term tends to experience an increase in procurement contracts (Goldman et al., 2013). The relationship with the political world also brings the benefit of regulatory protection and lower taxation for firms. Moreover, firms with this connection often show worse performance in leverage, accounting, market power, and productivity (Faccio, 2010). In addition, other studies find a positive effect of exporting on the TFP of firms. TFP is likely to determine a firm's export and select itself into new (foreign) markets. Only the most productive firms can compete in the world market and be able to afford the costs of entering into an export market. In addition, firms had to meet strict requirements of export markets that also forced them to increase productivity (Grossman & Helpman, 1991).

However, using firm-level data can result in various sets of determinants due to the characteristics of each industry examined. For example, in agriculture, determinants of TFP include price and non-price factors. Price factors refer to farm prices. Non-price elements contain government investment in R & D, inputs, credit, rural literacy, marketing and banking infrastructure density, and land reforms (Bhupat & Namboodiri, 1997). In many cases, the investigation of TFP determinants depends on the sectors explored and available variables of the datasets.

2. Methods and data

2.1. TFP estimation

Applying the TFP calculation method of (Şeker & Saliola, 2018), this study uses the production function to calculate the TFP of seafood firms in 28 coastal provinces of Vietnam. The production function has the form as follows:

$$Y_{it} = A_{it} K_{it}^{\alpha} L_{it}^{\beta} M_{it}^{\phi}, \quad (1)$$

in which: + Y_{it} : output of firm i in year t;

+ K_{it}^{α} : input (capital) of firm i in year t;

+ L_{it}^{β} : input (labor) of firm i in year t;

+ M_{it}^{ϕ} : input (intermediary) of firm i in year t;

+ A_{it} : TFP of firm i in year t.

Y, K, L, M values are observable while *A* is not observable. Taking the natural logarithm of Equation (1) reveals a linear function as follows:

$$\log Y_{it} = \alpha \log K_{it} + \beta \log L_{it} + \phi \log M_{it} + \log A_{it}; \quad (2)$$

$$\log A_{it} = \log Y_{it} - \alpha \log K_{it} - \beta \log L_{it} - \phi \log M_{it}. \quad (3)$$

In order to control unobserved factors, this research uses the semi-parametric estimation method suggested by authors such as Olley and Pakes (1996), Levinsohn and Petrin (2003), Ackerberg et al. (2006) and Wooldridge (2009).

2.2. TFP estimation of the fisheries sector

Productivity measure taken from Equation (3) can be aggregated to the industry-level by calculating a weighted average of firm' contributions in the industry. In this study, the weight used to pool industry TFP from a firm is the proportion of output contribution at the firm level or the ratio of assistance to each firm's value-added (VA).

The industry's weighted average TFP reflects the fisheries sector's technological efficiency and considers the importance of firm size in terms of labor and other characteristics. In addition, the results can be used to analyze the impact of macro factors on the productivity of the fisheries sector. The weighted average total factor productivity of the fisheries sector in 28 coastal provinces at time t is calculated as follows:

$$TFP_t = \sum_i \alpha_{it} \times TFP_{it},$$

in which: TFP_t – *TFP* of the fisheries sector in year t; $\alpha_{it} = VA_{it}/VA_t$ is the proportion of value added (*VA*) of firm i in year t in *VA* of fisheries in year t; TFP_{it} is the *TFP* of firm i in year t.

Previous studies have examined different determinants of TFP of a sector. Determinants can be institutional factors or the location of firms. North (1994) read the role of institutions (e.g. improved government performance) in enhancing productivity and reducing business transaction costs. Djankov et al. (2006) assert that supports for firms promote productivity growth. In addition, studies on agglomerating economies believe that total factor productivity tends to be higher in larger cities (Combes et al., 2012; Glaeser & Resseger, 2010) where there are more skilled workers.

Thus, Equation (4) considers the effect of determinants on the productivity of the fisheries sector in 28 coastal provinces of Vietnam as follows:

$$TFP_t = \alpha_0 + \alpha_1 X + \alpha_2 Z + \varepsilon_{t,}, \quad (4)$$

in which: TFP_t – *TFP* of the fisheries sector in 28 coastal provinces.

X – Factors from the macro-environment include:

- Distance from region i to the regional center. Studies have shown that being located in or near large cities provinces with convenient transportation to the center attract more large enterprises and have higher productivity (Combes et al., 2012);
- PCI_t of each province includes composite PCI and component indicator. PCI is the Provincial Competitiveness Index, a proxy to the impact of business environment on productivity;
- *Z*: Characteristics of firms in the seafood industry, including firm size and ownership. However, during 2012–2018, of all 8,833 seafood enterprises in 28 coastal provinces, 97.9% are micro and small enterprises and 99% are private enterprises. Therefore, in the estimation model, firm size and type of ownership are not included.

The lagged *X* variables are examined to ensure a causal relationship among dependent variables (change in *TFP* level and *TFP* growth) and the explanatory variables so that Equation (4) and (5) can help prevent endogenous problems between TFP year *t* and *X* year *t*. In order to remove the fixed effects of provincial environment such as cultural and natural advantages, geographical location… that may affect the selection of firm site, Equation (5) is used.

$$\Delta TFP_t = \alpha_0 + \alpha_1 \Delta X + \alpha_2 Z + \varepsilon_t. \quad (5)$$

2.3. Data

This paper uses firms' data from Vietnam Enterprise Survey (VES) conducted annually by the General Statistics Office since 2001. Data are collected from firms operating at the time of the survey across the country. This large-scale survey covers almost all firms, even small-sized ones with less than 20 active employees. In this study, the paper uses panel data of firms from 2012–2018 to investigate determinants of the TFP of the fisheries sector in 28 coastal provinces of Vietnam. All monetary variables of firms are adjusted for deflation using 2010 as the base year. The unit of labor variable (L) is the number of workers employed in a year while variables of capital (K), intermediate value (M), value-added (VA) and revenue (R) are in the unit of million VND.

Data about the provincial business environment are from PCI statistics collected and calculated annually by Vietnam Chamber of Commerce and Industry (VCCI). PCI_{it} is the voice of the business community about provincial government's performance i in year *t*. The composite PCI includes different components: (1) cost of market entry, (2) access to land and business space; (3) access to information; (4) time costs; (5) unofficial costs; (6) level of fair competition; (7) the dynamism and pioneers of provincial leaders; (8) business support services; (9) human training and development; (10) legal institutions. Each component ranges from 0 to 10. Descriptive statistics of average scores of PCI components among 28 coastal provinces are presented in Table 1. A province performance is good when components pci1, pci4, pci5 are close to 0 and the rest approximate 10. Figure 1 describes much room for 28 coastal provinces to enhance their governmental performance and business environment.

Our sample covers 28 coastal provinces of Vietnam, including Quang Ninh, Hai Phong, Thai Binh, Nam Dinh, Ninh Binh (Red River Delta-region 1); Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang Tri, Thua Thien Hue (North Central-region 2); Da Nang, Quang Nam, Quang Ngai, Binh Dinh, Phu Yen, Khanh Hoa, Ninh Thuan, Binh Thuan (Central coast-region 3); Ba Ria - Vung Tau, Ho Chi Minh city (Southeast-region 4); Tien Giang, Ben Tre, Tra Vinh, Soc Trang, Bac Lieu, Kien Giang, Ca Mau (Southwest-region 5). The 28 coastal provinces are grouped into five geographical regions accordingly. The regions are in parentheses. Tables A1 and A2 in Appendix provide more information of these provinces about TFP and its contribution to the fisheries industry.

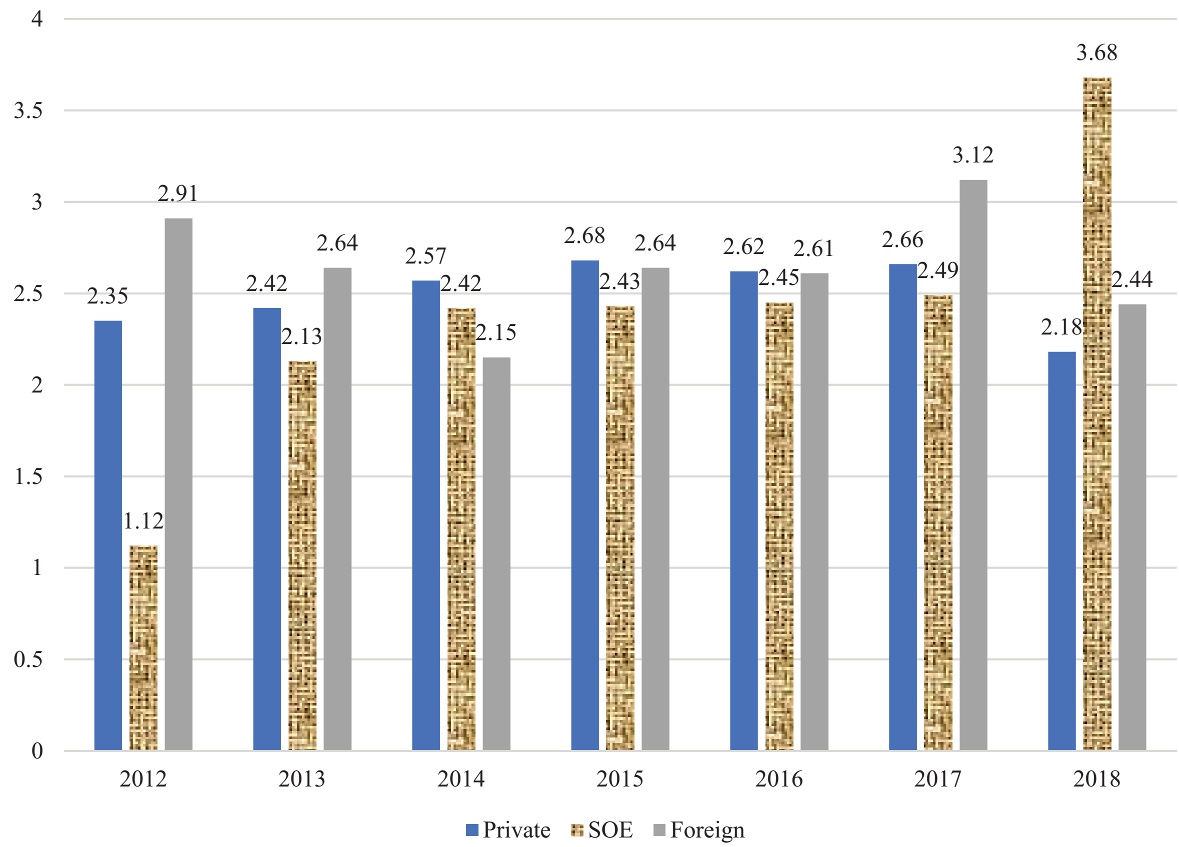

Figure 1. Room for 28 coastal provinces to enhance their governmental performance and business environment by enterprises

Table 1. Average scores of PCI components of 28 coastal provinces from 2012–2018 (source: Data from VCCI's PCI reports from 2012–2018)

PCI component		Obser-vation	Mean	Stan-dard Devia-tion	Min	Max
Var	Name					
pci1	Cost of market entry	8,833	8.10	0.80	5.87	9.60
pci2	Access to land and business space	8,833	6.66	0.78	4.87	8.84
pci3	Access to information	8,833	5.96	0.51	4.49	7.63
pci4	Time cost	8,833	7.16	0.79	3.57	8.54
pci5	Unofficial costs	8,833	6.38	1.13	3.77	8.94
pci6	Level of fair competition	8,833	4.94	2.11	0.00	8.19
pci7	Dynamism and pioneership of provincial leaders	8,833	5.37	0.79	1.39	7.72
pci8	Business sup-port services	8,833	5.68	1.05	2.61	7.82
pci9	Human training and development	8,833	5.61	0.69	4.06	8.17
pci10	Legal institution	8,833	5.90	1.01	2.45	7.66
Composite PCI		8,833	60.96	2.96	52.23	70.69

Provinces near a big city often enjoy better access to international trade and transactions, a large consumer market and easy and convenient connections to other provinces in the region. The greater the distance from one province to the center of the region, the greater the cost of transporting products to consumers, which means weaker economic links and less favorable conditions for industry development. To calculate the distance from one province to the center, regional centers are identified as follow:

– For region I, II: Hanoi city;
– For region III: Danang city;
– For region IV, V: Ho Chi Minh city.

First, the distance to the center of the province is calculated using the below formula:

$$Dis_{jr} = \frac{Distance_{jr}}{Aver\_dis_r},$$

in which: Dis_{jr}: The index of distance to the center of the province *j* in group *r*; $Distance_{jr}$: Distance from province *j* in group *r* to the center of group *r* (km); $Aver\_dis_r$: The average distance of provinces in region *r* to the center of region *r* (in km) is calculated by the formula:

$$Aver\_dis_r = \frac{\sum Distance_{jr}}{n_r},$$

in which: $\sum Distance_{jr}$: Total distance from the center of the provinces to the center of the region; n_r: Number of provinces in the sub-region *r*.

In general, based on the production function, this research measures the effect of critical explanatory factors on the productivity of the fishery sector in the principal coastal regions. With a panel data analysis, the data for labour, financial capital and others is from the national annual enterprise survey in the current study. Meanwhile, the index of the local business environment, including the cost of market entry, time costs or other information and others, is the annual report from the chamber of commerce and industry.

3. Findings and discussion

Factors affecting the TFP of the fishery industry in 28 coastal provinces of Vietnam are estimated in model 1 and the TFP of enterprises in the fishery industry in model 2. The variable of distance from the province to the sub-regional center has a constant value over time. Therefore, the paper uses the REM model (random effect model) to estimate models (1) and (2). For eliminating autocorrelation and multicollinearity, a robust estimate with orthogonal standard deviation (robust) is used. The estimation results are as follows in Table 2:

Table 2. Estimation results of factors affecting TFP of the fishery industry

Variable	TFP of the fishery industry	TFP of the firm in the fishery industry
Cost of entering the market	0.161**	0.083*
	–0.031	–0.038
Land accessibility	0.084*	0.074*
	–0.033	–0.031
Information accessibility	0.294**	0.257**
	–0.051	–0.051
Time cost	0.232**	-0.052+
	–0.028	–0.031
Unofficial expenses	–0.361**	–0.021
	–0.029	–0.031
Equal level of competition	0.122**	0.016
	–0.011	–0.012
Dynamic and pioneering of provincial leaders	0.009	0.141**
	–0.016	–0.02
Business support service	–0.196**	0.116**
	–0.024	–0.029
HR training and development	–0.131**	0.004
	–0.029	–0.042

End of Table 2

Variable	TFP of the fishery industry	TFP of the firm in the fishery industry
Legal institution	0.165**	0.124**
	–0.022	–0.023
Size of firm	0.346**	0.234**
	–0.034	–0.063
Import (Y)	–0.159*	0.177
	–0.074	–0.168
Export (Y)	–0.228	–0.188
	–0.185	–0.282
Distance from province to center of sub-region	0.067**	–0.057*
	–0.02	–0.022
Constance	2.571**	–1.140+
	–0.541	–0.622
Number of observations	5,562	3,892

Note: Robust standard errors in parentheses;

** $p < 0.01$, * $p < 0.05$, + $p < 0.1$.

3.1. The effect of the macro-environment on the productivity of the fisheries sector (estimated coefficients of the component PCI indexes)

Estimated coefficients of PCI component indicators show the impact of state management on the productivity of the fisheries sector in 28 coastal provinces of Vietnam. At the industry level, cost of market entry, access to land, access to information and cost of time are positively correlated with industry productivity. Accordingly, when these indicators are improved and increased, the productivity of the fishery industry also increases. This result is similar to previous studies on the impact of state management on productivity. In other words, when good state management reduces official costs incurred by enterprises, the TFP of the fisheries sector in the province will increase and vice versa.

Similarly, in the model for firm TFP, estimated coefficients of indicators such as cost of market entry, access to land, access to information, and price of time are also statistically significant and positively associated with firms' productivity. Meanwhile, unofficial expense index estimates show a negative effect on industry productivity. When informal payments by firms decrease, the productivity of the fisheries sector in the 28 provinces increases. In other words, a more transparent market will facilitate the improvement in the TFP of the fishery industry. Although the sign of the coefficient of unofficial expenses is negative at the firm level, it is not significant.

The role of state management in the sector's TFP is also reflected in such indicators as equal competition, the dynamism of provincial leaders, and the legal institution for dispute resolution. These indicators have a positive relationship with the fishery industry's productivity and TFP of fishery firms in the coastal provinces of Vietnam. This association also shows that the more transparent the business environment, the higher the productivity of the seafood industry.

3.2. The effect of firm characteristics on the productivity of the seafood industry

Estimation results of model 1 and model 2 reveal that firm size has a positive effect on the productivity of the seafood industry. The larger the enterprise, the higher the productivity and vice versa. This research is in line with work by (Kim et al., 2009), who believe that it has long been recognized that worker wages and productivity are higher in large firms. The authors use inventor panel data to examine the relationship between inventor productivity and firm size in the pharmaceutical and semiconductor industries. Both industries find that inventors' productivity increases with firm size even after controlling for inventors' experience, education, and other firm characteristics. They find evidence in the pharmaceutical industry that this is partly accounted for by differences in how large and small firms organize R&D activities. This result is also similar to other research when (Tovar et al., 2011) look at the electricity sector in Brazil. They apply Stochastic Frontier Analysis through a distance function to investigate the impact of a firm's size on productivity development in electricity distribution using a sample of eighteen Brazilian firms from 1998 to 2005. The authors find that productivity is decomposed into technical efficiency, scale-efficiency and technical change. They conclude firm size is essential for the industry's productivity and, therefore a key aspect to consider when making decisions that affect the market structure in the electricity distribution industry.

The variable of import activities has a negative relationship with the productivity of the fisheries sector, while export activities are not statistically significant. This means that increased imports will reduce the total factor productivity of the fisheries sector in 28 coastal provinces. It is normal since this nation exports more than imports, so if the volume of seafood products is imported, this trading activity can harm the fisheries sector in Vietnam. However, this result is actually in part which is similar to several situations. For example, one paper investigates the distinct effects of capital and intermediates imports on firms' productivity growth and quantifies the importance of tariff structure in trade liberalization in developing countries (Mo et al., 2021). Using a large panel of Chinese manufacturing firms, these authors demonstrate that capital import has substantially more productivity than intermediates import. In addition, regarding the effects of China's input tariff liberalization following its WTO accession, the change in tariff structure explains 18 percent of the productivity gains. In addition, using different dynamic panel estimators across 25 European countries and nine food industries, (Olper et al., 2014) discover that an increase in import penetration is systematically positively related to productivity growth. Interestingly, this positive relationship is almost exclusively driven by competition in final products from developed (especially EU-15) countries suggesting that EU food imports are closer substitutes for domestic production than non-EU imports.

Finally, in this research, the coefficient of the distance from the province to the center of the sub-region confirms that a closer distance between the province and the center of the sub-region encourages the increase of firm TFP. This variable has a strong effect on TFP at a very high significance level of 1%. Seafood product for trading and exporting surely indeed obtains higher advantages if firms are closer to the centers. Contrastingly, another result mentions the relationship between geographical distance and firm performance (Moaniba et al., 2020). Focusing on a different view on geographical distance and productivity, the authors investigate the relationship between inventor distance and firm performance by employing panel fixed effect quantile regression techniques with interaction variables on a sample of 556 firms. The study finds empirical evidence that the geographic distance between collaborating inventors positively affects firm performance. This effect is more substantial in companies that engage in inventor collaborations across international borders and weaker in multi-national corporations that rely only on intra-firm inventor collaborations.

3.3. Theoretical implications

This study shows a new grasp of the fishery sector's TFP in the background of the provincial competitiveness index and other explanatory factors. The current research re-confirms the hypothesis that qualified services and support from the authorities will boost the TFP of the fishery sector and the firms within this sector. This research also highlights the legal institution's role and the firm's size by analyzing these factors in the empirical models. It is certain that if legal policies are always reformed by the authorities and the magnitude of firms is large enough, the firms' TFP will also be higher. Different theoretical approaches in the fishery industry are recommended based on the results.

3.4. Managerial implications

The findings revealed some managerial aspects for the fishery industry and the firms in this sector. Firstly, the result suggested that the authorities should find the best way to reduce the cost of entering the market. The authorities may apply modern technologies so that firms do not incur the high charge of joining the market and will save money to get higher productivity. Secondly, firms can easily access information in the digital era if the authorities provide enough facilities and platforms. When they obtain adequate knowledge and data about the market and administrative procedures, the firms can improve their productivity for themselves and the fishery industry. Besides financial capital, data can be considered a source of capital since the firms can analyze information and promulgate business decisions in time. Furthermore, suppose the authorities can provide fast, reliable and qualified internet connections, in that case, the firms will undoubtedly save their time and reduce other costs because the time from the firms means their success and revenue.

Thirdly, perhaps the most important thing is the legal institution. The finding showed it has a significant relationship with the firms' productivity in both models. The result proposed that legal policies should be more transparent, effective and consistent with the firms in this industry. If the authorities ensure these things, the firms can build long strategies for themselves and get their highest productivity level in the long term rather than in the short time.

Conclusions

The study of factors affecting TFP of the fisheries industry in 28 coastal provinces of Vietnam confirms that both the macro environment and the characteristics of enterprises in the industry have a statistically significant impact on the productivity of the fishery industry. At the macro level, the more transparent the macro environment, the higher the TFP. Thus, it is required that the local authorities of the coastal provinces of Vietnam need to accelerate the reform of administrative procedures, creating a favorable business environment for seafood enterprises. At the same time, along with the reform of managerial functions, provinces also need to improve their infrastructure to attract businesses to invest in the province. At the micro-level, the variable of firm size is directly proportional to the TFP of Vietnam's seafood industry. The larger the enterprise, the higher the productivity. In a labor-intensive industry such as the fishery industry, productivity increases as labor increases, indicating a low scientific and technological application in the fisheries sector. To increase the industry's productivity of one industry, it is necessary to support the state to increase the size of domestic enterprises.

Research limitations and future studies

The current research focused on the key variables affecting TFP and excluded lagged factors among these variables, such as import, export or other information. It is better if the lagged variables were put in the empirical models since their elasticity by years could provide more exciting ideas. Secondly, in some research, the random effect model and the fixed effect model are parallelly analyzed and chosen by the Hausman test rather than by the nature of the data. On the other hand, the models with three classified regions were not used as dichotomous variables. The TFP in the south, where the business environment is more attractive, may be affected more strongly by the independent factors than that in the other regions. As such, specific implications based on the results are given to each region rather than the whole scale. Last but not least, PCI is an integrated index and it includes many components. Nevertheless, it had not been put in the model as an integrated factor, so some missing information may come out.

This research has been carried out in Vietnam and future studies could follow this model by collecting and analyzing data from different regions. Comparisons on the findings may benefit researchers and policymakers when they propose policies for higher productivity in the fisheries sector. Similarly, this study uses some control variables and other vital factors nevertheless, it is helpful if more critical variables can be regressed such as technological supports, public facilities, or quality of available transporting services. These factors may strongly affect TFP, especially in the case of developing nations. Besides, information of financial capital also plays an essential role in contributing to productivity within fishery firms or within the industry. The higher financial capital one firm likely has, the higher propensity it can enhance its productivity and this capital is also true for the whole fishery industry. It can be done in future studies if authors take a look at this variable.

Another crucial factor nontrivial is the number of establishing years from each firm. Supposing more information about the year when one firm joins the industry is set in the model, the data may reveal whether one firm operating long in the fisheries sector has higher productivity than the other ones. Finally, interactions for further studies among main variables in empirical models certainly provide more details if one variable depends on the other one and vice versa.

References

Ackerberg, D., Caves, K., & Frazer, G. (2006). *Structural identification of production functions*. EconPapers. https://EconPapers.repec.org/RePEc:pra:mprapa:38349

Ackerberg, D. A., Caves, K., & Frazer, G. (2015). Identification properties of recent production function estimators. *Econometrica, 83*(6), 2411–2451. https://doi.org/10.3982/ECTA13408

Bhupat, M. D., & Namboodiri, N. V. (1997). Determinants of total factor productivity in Indian agriculture. *Economic and Political Weekly, 32*(52), A165–A171.

Combes, P.-P., Duranton, G., & Gobillon, L. (2018). The costs of agglomeration: House and land prices in French cities. *The Review of Economic Studies, 86*(4), 1556–1589. https://doi.org/10.1093/restud/rdy063

Combes, P.-P., Duranton, G., Gobillon, L., Puga, D., & Roux, S. (2012). The productivity advantages of large cities: Distinguishing agglomeration from firm selection. *Econometrica, 80*(6), 2543–2594. https://doi.org/10.3982/ECTA8442

Comin, D. (2010). Total factor productivity. In S. N. Durlauf & L. E. Blume (Eds.), *Economic growth* (pp. 260–263). Palgrave Macmillan. https://doi.org/10.1057/9780230280823_32

Djankov, S., McLiesh, C., & Ramalho, R. M. (2006). Regulation and growth. *Economics Letters, 92*(3), 395–401. https://doi.org/10.1016/j.econlet.2006.03.021

Faccio, M. (2010). Differences between politically connected and nonconnected firms: A cross-country analysis. *Financial Management, 39*(3), 905–928. https://doi.org/10.1111/j.1755-053X.2010.01099.x

Giang, M. H., Xuan, T. D., Trung, B. H., & Que, M. T. (2019). Total factor productivity of agricultural firms in Vietnam and its relevant determinants. *Economies, 7*(1), 4. https://doi.org/10.3390/economies7010004

Glaeser, E. L., & Resseger, M. G. (2010). The complementarity between cities and skills. *Journal of Regional Science, 50*(1), 221–244. https://doi.org/10.1111/j.1467-9787.2009.00635.x

Goldman, E., Rocholl, J., & So, J. (2013). Politically connected boards of directors and the allocation of procurement contracts. *Review of Finance, 17*(5), 1617–1648. https://doi.org/10.1093/rof/rfs039

Grossman, G. M., & Helpman, E. (1991). Trade, knowledge spillovers, and growth. *European Economic Review, 35*(2), 517–526. https://doi.org/10.1016/0014-2921(91)90153-A

Isaksson, A. (2007). *Determinants of total factor productivity: A literature review.* United Nations Industrial Development Organization.

Johnson, S., & Mitton, T. (2003). Cronyism and capital controls: Evidence from Malaysia. *Journal of Financial Economics, 67*(2), 351–382. https://doi.org/10.1016/S0304-405X(02)00255-6

Kim, J., Lee, S. J., & Marschke, G. (2009). Inventor productivity and firm size: Evidence from panel data on inventors. *Pacific Economic Review, 14*(4), 516–531. https://doi.org/10.1111/j.1468-0106.2009.00469.x

Levinsohn, J., & Petrin, A. (2003). Estimating production functions using inputs to control for unobservables. *The Review of Economic Studies, 70*(2), 317–341. https://doi.org/10.1111/1467-937X.00246

Li, F., Xing, W., Su, M., & Xu, J. (2021). The evolution of China's marine economic policy and the labor productivity growth momentum of marine economy and its three economic industries. *Marine Policy, 134*, 104777. https://doi.org/10.1016/j.marpol.2021.104777

Mo, J., Qiu, L. D., Zhang, H., & Dong, X. (2021). What you import matters for productivity growth: Experience from Chinese manufacturing firms. *Journal of Development Economics, 152*, 102677. https://doi.org/10.1016/j.jdeveco.2021.102677

Moaniba, I. M., Su, H.-N., & Lee, P.-C. (2020). Geographic distance between co-inventors and firm performance: The moderating roles of interfirm and cross-country collaborations. *Technological Forecasting and Social Change, 157*, 120070. https://doi.org/10.1016/j.techfore.2020.120070

North, D. C. (1994). Economic performance through time. *The American Economic Review, 84*(3), 359–368.

Olley, G. S., & Pakes, A. (1996). The dynamics of productivity in the telecommunications equipment industry. *Econometrica, 64*(6), 1263–1297. https://doi.org/10.2307/2171831

Olper, A., Pacca, L., & Curzi, D. (2014). Trade, import competition and productivity growth in the food industry. *Food Policy, 49*, 71–83. https://doi.org/10.1016/j.foodpol.2014.06.004

Saliola, F., & Şeker, M. (2012). *Measuring total factor productivity using micro-level data from enterprise surveys.* Enterprise Analysis Unit.

Şeker, M., & Saliola, F. (2018). A cross-country analysis of total factor productivity using micro-level data. *Central Bank Review, 18*(1), 13–27. https://doi.org/10.1016/j.cbrev.2018.01.001

Solow, R. M. (1957). Technical change and the aggregate production function. *The Review of Economics and Statistics, 39*(3), 312–320. https://doi.org/10.2307/1926047

Syverson, C. (2011). What determines productivity? *Journal of Economic Literature, 49*(2), 326–365. https://doi.org/10.1257/jel.49.2.326

Teh, L. C. L., & Sumaila, U. R. (2013). Contribution of marine fisheries to worldwide employment. *Fish and Fisheries, 14*(1), 77–88. https://doi.org/10.1111/j.1467-2979.2011.00450.x

Tovar, B., Javier Ramos-Real, F., & de Almeida, E. F. (2011). Firm size and productivity. Evidence from the electricity distribution industry in Brazil. *Energy Policy, 39*(2), 826–833. https://doi.org/10.1016/j.enpol.2010.11.001

Van Beveren, I. (2012). Total factor productivity estimation: A practical review. *Journal of Economic Surveys, 26*(1), 98–128. https://doi.org/10.1111/j.1467-6419.2010.00631.x

Vietnam association of seafood exporters and producers. (2021). *Report on Vietnam seafood exports in 2020*. https://seafood.vasep.com.vn/reports

Wang, S., Lu, B., & Yin, K. (2021). Financial development, productivity, and high-quality development of the marine economy. *Marine Policy, 130*, 104553. https://doi.org/10.1016/j.marpol.2021.104553

Wang, S. L., & Walden, J. B. (2021). Measuring fishery productivity growth in the Northeastern United States 2007–2018. *Marine Policy, 128*, 104467. https://doi.org/10.1016/j.marpol.2021.104467

Wooldridge, J. M. (2009). On estimating firm-level production functions using proxy variables to control for unobservables. *Economics Letters, 104*(3), 112–114. https://doi.org/10.1016/j.econlet.2009.04.026

APPENDIX

Table A1. TFP of the seafood industry by provinces in the period 2012–2018 (source: calculated by authors)

Province	2012	2013	2014	2015	2016	2017	2018
BRVT	1.40	1.78	2.67	2.18	2.58	2.68	2.12
Binh Thuan	3.47	2.15	2.27	2.03	2.39	2.12	1.89
Binh Dinh	2.58	3.99	2.15	3.65	3.31	0.50	3.17
Bac Lieu	3.01	1.99	2.88	2.86	1.49	3.14	1.53
Ben Tre	2.71	3.14	3.12	3.17	3.08	3.09	4.08
Ca Mau	1.55	2.18	1.80	2.73	2.61	2.05	2.80
Ha Tinh	1.13	2.12	1.27	2.38	2.97	2.05	2.63
Hai Phong	3.36	1.29	0.65	1.52	2.43	0.84	0.96
Khanh Hoa	3.13	2.19	1.33	1.98	3.66	3.26	3.94
Kien Giang	2.63	2.66	2.76	2.96	2.90	2.91	1.26
Nam Dinh	0.54	1.39	1.94	2.26	2.25	1.23	0.35
Nghe An	1.27	1.78	1.65	1.98	2.90	3.79	1.77
Ninh Binh	1.85	0.35	0.21	1.51	1.60	1.50	3.05
Ninh Thuan	2.92	3.26	3.72	3.01	2.66	1.90	1.34
Phu Yen	1.74	2.45	2.65	2.73	2.49	2.57	2.55
Quang Binh	1.86	2.91	2.43	1.69	2.59	1.57	2.00
Quảng Nam	–0.23	1.21	2.18	1.26	0.00	0.00	0.00
Quang Ngai	1.59	1.87	2.95	0.00	0.00	0.27	0.09
Quang Ninh	1.80	2.45	1.77	2.33	2.12	3.17	1.70
Quang Tri	–0.01	1.09	0.00	0.00	0.54	0.00	1.79
Soc Trang	0.17	0.95	0.81	2.95	3.44	2.66	1.68
HochiMinh	0.29	2.12	0.95	2.83	1.07	1.11	1.34
TT-Hue	2.81	2.70	0.00	1.09	0.64	0.04	2.35
Thanh Hoa	1.67	2.28	1.24	0.00	0.00	0.00	0.13
Thai Binh	2.29	2.32	2.35	2.54	0.25	2.68	1.33
Tien Giang	2.28	2.25	2.50	2.27	2.43	2.14	1.76
Tra Vinh	1.35	1.85	1.77	2.24	1.95	2.64	0.05
Đa Nang	0.00	–0.03	0.00	0.00	0.00	1.87	1.39
Total	2.41	2.55	2.61	2.79	2.71	2.49	1.59

Table A2. Contribution of TFP to the VA of the fisheries sector by 5 sub-regions in the period 2012–2018 (%)
(source: calculated by authors)

Province	2012	2013	2014	2015	2016	2017	2018
BRVT	22.3%	33.8%	41.0%	33.1%	40.6%	37.5%	44.0%
Binh Thuan	29.1%	32.4%	28.9%	29.2%	28.9%	31.2%	21.7%
Binh Dinh	35.9%	33.4%	29.5%	33.9%	38.8%	43.6%	34.6%
Bac Lieu	40.3%	38.6%	41.8%	38.9%	38.8%	41.8%	45.6%
Ben Tre	36.7%	40.4%	38.8%	38.5%	36.5%	37.3%	43.6%
Ca Mau	42.0%	35.4%	38.5%	33.9%	31.1%	39.6%	36.8%
Ha Tinh	28.0%	38.0%	35.9%	31.6%	26.1%	32.0%	26.2%
Hai Phong	38.4%	31.0%	30.9%	23.2%	25.6%	37.6%	37.7%
Khanh Hoa	42.1%	30.6%	30.9%	32.0%	34.4%	38.6%	34.1%
Kien Giang	33.5%	33.5%	34.4%	35.6%	35.4%	35.4%	29.8%
Nam Dinh	14.2%	22.7%	31.8%	35.2%	33.3%	9.5%	33.9%
Nghe An	36.7%	30.5%	25.4%	32.5%	27.6%	34.6%	12.1%
Ninh Binh	35.1%	25.6%	5.7%	29.4%	30.7%	36.7%	38.5%
Ninh Thuan	33.4%	38.7%	38.9%	30.4%	39.0%	40.3%	45.3%
Phu Yen	27.4%	34.6%	34.3%	35.1%	35.2%	41.1%	23.8%
Quang Binh	31.1%	34.2%	26.0%	29.2%	30.9%	30.8%	13.2%
Quảng Nam	–44.7%	26.6%	40.8%	30.1%	0.0%	0.0%	0.0%
Quang Ngai	22.3%	28.7%	40.9%	0.0%	0.0%	24.3%	47.4%
Quang Ninh	30.0%	31.3%	31.3%	29.9%	26.8%	33.4%	28.4%
Quang Tri	–0.7%	11.0%	0.0%	0.0%	13.8%	0.0%	32.3%
Soc Trang	28.7%	28.2%	21.5%	23.5%	22.1%	34.3%	33.2%
HochiMinh	–5.8%	39.6%	37.0%	34.2%	38.1%	40.0%	39.4%
TT-Hue	46.6%	34.5%	0.0%	39.4%	20.8%	15.8%	44.6%
Thanh Hoa	29.2%	38.2%	31.3%	0.0%	0.0%	0.0%	54.4%
Thai Binh	29.1%	31.2%	31.3%	30.2%	18.4%	31.8%	24.9%
Tien Giang	29.8%	31.5%	31.1%	30.2%	31.0%	25.0%	26.0%
Tra Vinh	25.2%	33.8%	38.9%	45.0%	42.5%	39.9%	40.3%
Đa Nang	0.0%	–129.1%	0.0%	0.0%	0.0%	50.7%	59.1%
Total	33.9%	34.9%	34.9%	35.2%	34.9%	35.5%	32.1%