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FORECASTING VIETNAM'S FISHERY EXPORT VALUE USING HOLT–WINTERS EXPONENTIAL SMOOTHING

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Abstract

The seafood industry is considered one of Vietnam's spearhead economic sectors. The export of fishery products peaked in 2022 at 11 billion USD since Vietnam participated in the international seafood market in the early 1990s. However, the COVID-19 pandemic and the Russia-Ukraine war have severely affected the seafood export industry. The expansion of COVID-19 has posed challenges for fish trade worldwide. During the social distancing period, Vietnam's fishery export value observed a downward trend. When the conflict between Russia and Ukraine broke out, export transactions from Vietnam to both countries were halted and agriculture trade was significantly reduced. In the context of the seafood export industry starting to recover, forecasting the prospects of recovery is necessary to implement appropriate and timely measures for development of fishery export of Vietnam. This research uses the Holt-Winters exponential smoothing method to forecast Vietnam's fishery export value in the first half of 2024. The forecasting results follow the seasonal pattern from the previous years in the time series, showing significant fluctuations and lower than the previous year.

Keywords: Fishery export, Forecast, Exponential smoothing.

1. Introduction

Vietnam's fisheries industry has long been a vital component of the global economy, owing to its extensive coastline and abundant marine resources. Over the years, the nation has emerged as a significant player in the international fisheries trade, with exports contributing significantly to its economic growth and development (Quang, 2023). The fishery sector not only supports

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livelihoods and provides employment but also serves as a crucial source of food for millions of people worldwide (Sustainable Fisheries and Aquaculture for Food Security and Nutrition, 2014). Fishery activities contribute significantly to economic growth. According to the United Nations Industrial Development Organization (2020), in 2018, fish exports generated $164 billion, with about half coming from developing countries. The sector's positive impact on employment and income is expected to grow further through enhanced productivity, modernization, and increased access to farmed aquatic products (FAO's State of World Fisheries and Aquaculture 2022 Report, 2022).

In the three years since the COVID-19 pandemic, Vietnam's fishery industry swiftly rebounded, becoming the world's third-largest fishery exporter after China and Norway, with exports surpassing 11 billion USD in 2022 (Linh, 2023). This value was recorded up 24% year-on-year and 22% higher than the year's target of 9 billion USD. Vietnam has taken several proactive measures to recover the export value of fishery products in response to COVID-19. The country focuses on improving the sourcing of materials and enhancing the production process to set a strong foundation for future growth (VIRAC, 2023).

Currently, Vietnam's seafood products have been exported to 170 countries and territories. As the world population is projected to reach 9 billion by 2050 (United Nations Industrial Development Organization, 2020), sustainably harvested fish and seafood are crucial for global food security. To meet the increasing demand, both capture fisheries and aquaculture have expanded significantly (Sustainable fisheries and aquaculture for food security and nutrition. A report by The High Level Panel of Experts on Food Security and Nutrition, 2014). Due to geopolitical issues, supply chain disruptions, and reduced consumer demand in many countries, Vietnam's seafood industry is facing many difficulties. The industry also faces challenges with trade barriers and sustainability requirements for products, including social, environmental, and environmental aspects (ĐCSVN, 2023).

Despite the sector's importance and its steady growth trajectory, it faces numerous challenges, including the inherent volatility of global markets and the complexities of environmental factors. These challenges underscore the necessity for robust forecasting methods to anticipate changes in the fishery export landscape. Accurate forecasts are essential for policymakers, industry stakeholders, and investors to make informed decisions regarding resource allocation, market strategies, and economic planning.

Up to now, there have not been many studies providing export value forecasts for Vietnam's seafood industry. This research aims to provide a concise overview of the existing research landscape, emphasizing the gaps that the current study seeks to address. The escalating demand for accurate forecasting tools in the fisheries sector, given its economic importance, underscores the significance of this research endeavour.

For the above reasons, the authors chose the topic ***"Forecasting Vietnam's fishery export value using Holt-Winters exponential smoothing method".***

In that context, this study proposes to forecast Vietnam's seafood export value for the first half of 2024 using the Holt–Winters exponential smoothing technique based on the smallest MAPE index among all forecasting methods indicating the best forecast performances. The research aims to contribute to the precision of predictions in the fisheries sector, enabling

informed decision-making by stakeholders, policymakers, and industry participants. The findings of this study are expected to contribute to the enhancement of decision-making processes, enabling stakeholders to proactively address challenges and capitalize on opportunities in the fisheries sector.

The methodology involves applying the Holt–Winters exponential smoothing method, known for its effectiveness in capturing both trend and seasonality, to historical fishery export data. The study seeks to validate the model's performance and assess its predictive accuracy, ultimately contributing to the advancement of forecasting techniques for Vietnam's fisheries and supporting sustainable development in the face of market uncertainties. The results of the study will be presented to highlight the efficacy of the Holt–Winters exponential smoothing model in forecasting the export value of Vietnam's fishery products.

This research is not only timely but also highly relevant, especially in light of the projected increase in global population and the growing demand for seafood products. Sustainably harvested fish and seafood are crucial for ensuring global food security, making accurate forecasting of fishery export values imperative for the sustainable development of Vietnam's fisheries industry and the well-being of its communities.

The study proceeds as follows: Section 2 provides an overview of Vietnam fishery export and a review of literature on the Holt-Winters forecasting method. Following that, Section 3 discusses the study's research methodology and data collection. Then, Section 4 comes to the results, which state that Holt-Winters exponential smoothing is a suitable forecasting method for Vietnam's seafood exports. Finally, the article concludes with a discussion of the research findings in Section 5.

2. Overview of Vietnam fishery export and literature review

Vietnam is a Southeast Asian nation situated on the eastern side of the Indochinese Peninsula, covering an area of 331,345.70 km^2. The country boasts a coastline stretching over 3,260 km and holds an Exclusive Economic Zone (EEZ) spanning 1,395,096 km^2, extending 370.4 km from its shores. Due to the vast expanse of its EEZ, Vietnam is rich in marine resources. According to InsideTravel (2022), it is estimated that approximately 11,000 marine species inhabit 20 distinctive maritime environments. This presents substantial opportunities for resource replenishment and the development of various economic sectors, particularly in fisheries, including activities like marine fishing, aquaculture, and seafood processing.

Vietnam's fisheries industry is of utmost importance to the nation's economy, food security, and the livelihoods of its people. The country's extended coastline, intricate river networks, and abundant marine ecosystem make it ideally suited for various fisheries endeavors.

2.1. Vietnam's fishery export from 2010 to 2022

Vietnam is renowned as one of the world's largest exporters of seafood and fish products. Seafood has recently emerged as one of the most valuable export commodities, playing a vital role in Vietnam's export-oriented economy, as noted by Nguyen in 2022. The value of Vietnam's overall seafood exports reached a peak in 2022 at nearly USD 10,925 billion, according to the General Statistics Office of Vietnam. Among the key products, pangasius

topped the list in terms of export, followed by shrimp and tuna, as indicated by VietNamNet in 2023.

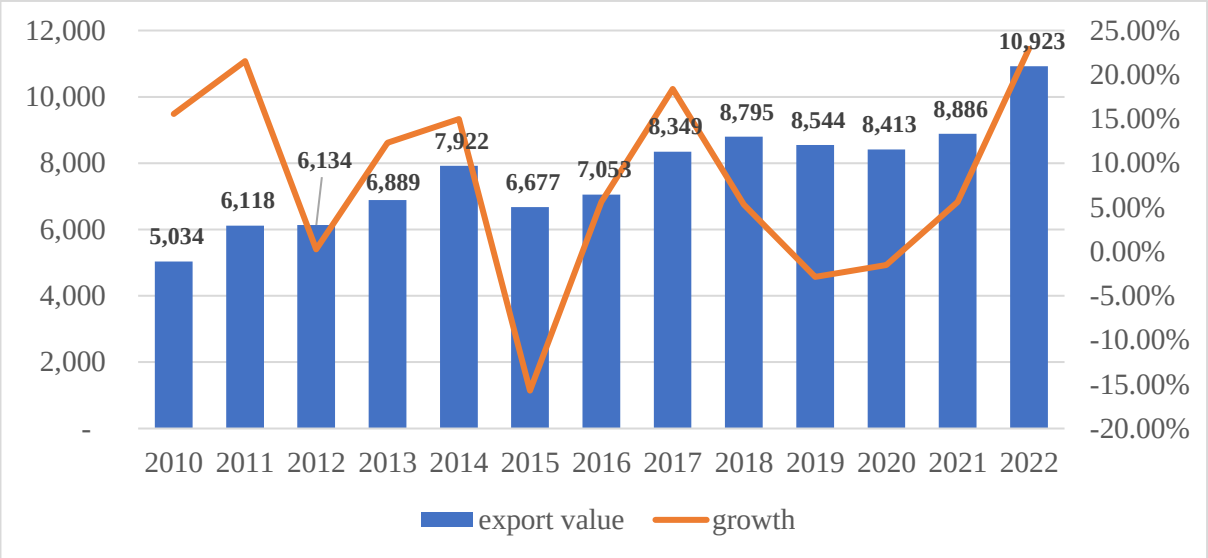

Figure 1. Vietnam's fishery export value from 2010 to 2022

Source: World Bank (2010-2016) and General Statistics Office (2017-2022)

Over the period from 2010 to 2022, the country's seafood exports have experienced many fluctuations. Closing out the year 2010, Vietnam's seafood industry achieved noteworthy progress, with seafood export turnover reaching USD 5.034 billion, marking a 15.55% increase compared to the same period in 2009, and this growth continued strongly into 2011. However, by 2012, amid a global economic downturn, the growth rate of the export value of various agricultural, forestry, and aquatic product groups experienced a significant reversal (Phuong, 2013). From the graph, it is evident that the growth rate of Vietnam's seafood export value was only 0.26%. In 2013, the rise of the seafood sector propelled the overall agricultural "train" to reach a total export turnover of USD 27.469 billion in 2013, a slight 0.7% increase compared to the previous year. Within that, the export value of seafood reached USD 6.8889 billion, and this figure continued to grow in the following year with a nearly 15% growth rate (Huong, 2013). However, the most significant challenge came in 2015 in the form of technical and trade barriers imposed by importing countries. Specifically, anti-dumping duties on pangasius in the U.S. market created turmoil for fish farmers and Vietnamese pangasius export businesses. In 2015, the U.S. Department of Commerce twice imposed anti-dumping duties on frozen pangasius products imported from Vietnam (Minh, 2015). 2015 proved to be a difficult year for Vietnam's seafood export activities, with a sharp decline in the export turnover of many key products. Exchange rate fluctuations and policies of importing countries also added to the challenges faced by the seafood sector, causing a significant drop-in growth rate to -15.72%. This situation gradually recovered in the following three years, reaching USD 8.544 billion in 2018.

Vietnam encountered substantial challenges due to the COVID-19 pandemic, resulting in a negative growth rate for the seafood export sector for 3 years from 2019 to 2021. By the end of 2021 and the beginning of 2022, signs of recovery began to emerge in the market. Despite facing significant impacts of the COVID-19 pandemic in 2021, particularly in the third quarter,

Vietnam's seafood exports made a remarkable turnaround in the late months of the year following the issuance of Resolution No. 128/NQ-CP by the government on October 11, 2021, concerning the temporary regulations for "adapting safely, flexibly, and effectively to the COVID-19 pandemic." (Trade, 2021). After a robust increase in November, seafood export turnover in December continued to surge by 23%, reaching USD 900 million in 2022, with the total seafood export value amounting to USD 8.886 billion.

In 2022, the industry recorded a growth rate of nearly 23%, and this growth trend has continued up to the present day.

2.2. Current situation of Vietnam's fishery export

Vietnam Association of Seafood Exporters and Producers (VASEP) reports that the estimated value of Vietnam's fishery exports reached $862 million as of September 2023, equivalent to the same period in 2022. Cumulatively, by the end of the third quarter of 2023, fishery exports exceeded $6.6 billion, a 22% decrease compared to the same period last year. The two primary markets, the United States and China, have begun to show increased demand, with both countries recording growth in fishery exports over the last two months. Several key markets within the CPTPP block, such as Japan, Australia, and Canada, are also increasing their imports of Vietnamese shrimp.

Similar to shrimp, the export of tuna from Vietnam is also showing signs of improvement, with September 2023 sales matching the levels of the same period in 2022. However, continuous declines in the early part of the year have resulted in a 23% decrease in cumulative 9-month tuna exports, reaching $623 million.

According to VASEP, the issuance of an import ban on all seafood products from Japan by the Chinese General Customs Administration, aimed at mitigating the risk of "Japanese nuclear-contaminated wastewater discharge" into the Pacific, has affected the seafood trade from August 2023 to the present. Fishery exports to China have been experiencing strong growth in September 2023, with a 17% increase compared to the previous year (VASEP, 2023).

By September 2023, although export value has increased nearly 10% compared to August 2023, this is still the 10th consecutive month recording a decrease in export value compared to the same period last year. The total accumulated export value of Vietnamese seafood as of September 2023 reached 6.64 billion USD, down 21.7% compared to the first 9 months of 2022.

This decline occurred in some major seafood export markets in Vietnam. 9/10 major seafood export markets recorded a double-digit decline in proportion - especially the US, Vietnam's largest seafood export market. Due to the impacts of inflation and the devaluation of the USD, the value of seafood exports to the US decreased by 37.2% in the first 8 months of 2023 (compared to the same period in 2022), greatly affecting the export turnover of the US. Vietnam in the same year.

For Japan and China (the 2nd & 3rd largest markets), this situation is also not very positive, witnessing a decrease of about 13.4% and 17.7% over the same period last year. Both of these markets witnessed a sharp decline in the first 8 months of the year, before returning to increase at the beginning of the fourth quarter of 2023 (InnovativeHub, 2023).

In addition to the decline in exports in major markets, Vietnam's seafood export industry is also affected by world seafood export prices. From the beginning of 2023, the average US seafood import price has decreased by about 10% compared to the same period in 2022. One of the products most heavily affected is shrimp, when India and Ecuador massively farmed it, causing supply to increase sharply, creating an imbalance between supply and demand, affecting prices. Therefore, businesses, in addition to price pressures, also face challenges in protecting market share, in parallel with developing and expanding the market (InnovativeHub, 2023).

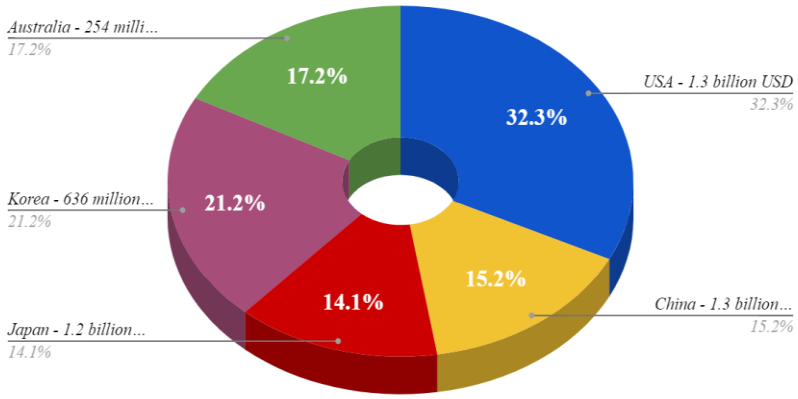

Figure 2. Top 5 seafood import markets of Vietnam in the first 10 months of 2023

Source: VASEP

Vietnam's seafood export turnover in November 2023 reached nearly 840 million USD, up 6% over the same period in 2022. Overall, in the first 11 months of 2023, seafood exports reached 8.27 billion USD, down 19% over the same period in 2022. % compared with the same period last year.

By the end of November 2023, pangasius exports have reached nearly 1.7 billion USD, still 26% lower than the same period last year. The average price of pangasius exports decreased in main markets, especially the US and China, pulling the value of pangasius exports lower than in 2022.

However, pangasius exports are showing more positive signs in some markets such as China, Mexico, Canada, Brazil, the UK... In addition to the main product which is pangasius filets, there are by-products such as pangasius bladder. Dried, pangasius fish cakes are of interest to many markets such as the US, China, Malaysia, and Singapore.

Table 1. Export turnover of each aquatic product in 11 months

	Nov-23	Growth rate	Jan-Nov 2023	Growth rate
Shrimp	310.246	3.5%	3153.592	-22.3%
Tuna	81.01	26.3%	773.949	-18.4%

Pangasius	164.274	12.6%	1689091	-26.4%
Other fishery product	185.081	4.1%	1737.749	-7.5%
Squid, Octopus	69.424	2.7%	606.604	-13.1%
Crabs and other crustaceans	22.479	1.2%	183.723	-11.9%

Source: VASEP

Key export aquatic products

Shrimp

According to information from VASEP, shrimp export turnover by the end of November 2023 is estimated to reach 3.15 billion USD, down 22% over the same period last year. Shrimp exports are also being affected by price competition due to a global surplus of shrimp supply, leading to falling selling prices. Shrimp exports to most major markets decreased over the same period, except for some small markets such as Hong Kong and Switzerland, which increased by 5%, and Taiwan increased by 19%.

China is likely to continue strong shrimp imports in the last quarter of 2023 to meet peak consumer demand in December, January, and February. However, in the United States, consumer demand will be met. Responded mainly by imports from Latin American countries due to lower transportation costs. Inflation is falling in major European countries. However, traders do not intend to start Christmas shopping as demand for crustaceans, including shrimp, remains weak.

Shrimp demand in Southeast Asia and the Far East is expected to improve towards the end of the year due to holidays such as Christmas, Lunar New Year, and Tet taking place from December to February. Prices during this period will increase due to the Low yields this season.

According to VASEP, the US continues to be Vietnam's largest shrimp import market, accounting for 21% of Vietnam's total shrimp export turnover. In the period from July to October this year, shrimp exports to the US recorded continuous double-digit growth. Cumulative shrimp exports to the US in the first 10 months of the year still decreased by 20% over the same period, reaching 589 million USD. This decrease is mainly due to the sharp decline in the first months of the year. However, there is good news that shrimp exports to the US have shown signs of recovery and growth in recent months.

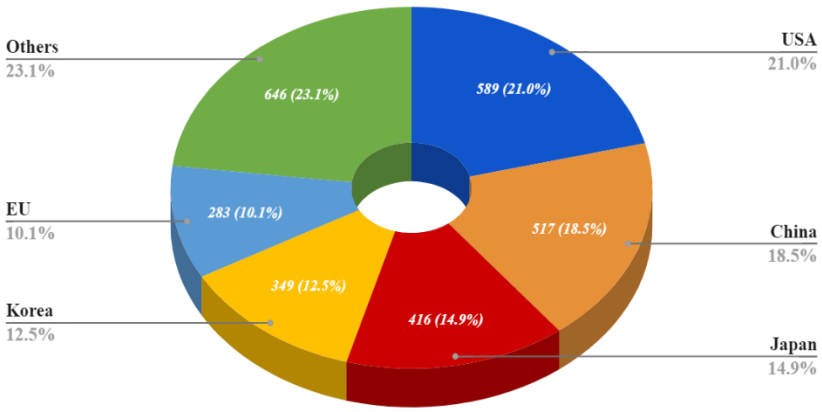

Figure 3. Shrimp export market structure in the first 10 months of 2023 (million USD)

Source: VASEP

Tuna

Tuna export turnover in the first 11 months of the year reached about 774 million USD, down 18% over the same period. However, compared to other commodities, tuna shows more positive signals. Although exports to the US decreased by 35%, many markets such as the EU, Thailand, Israel, Mexico, Russia, Korea, Philippines, and Japan are tending to increase tuna imports from Vietnam. Products including cans of steamed tuna and canned tuna are in better demand than frozen tuna filets, chunks, and other types.

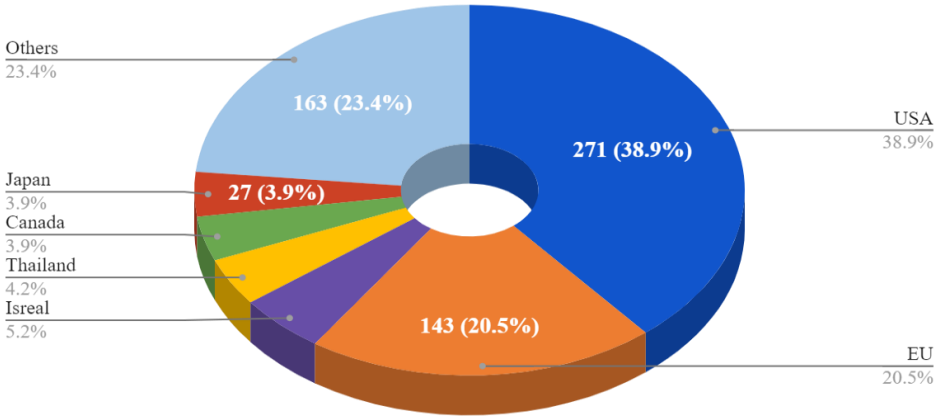

Figure 4. Tuna export market structure in the first 10 months of 2023 (million USD)

Source: VASEP

In October, tuna exports to the US and Canada recorded growth after many months of decline, with an increase of 6% over the same period. Meanwhile, tuna exports to the EU continued to record a decline in October. The value of tuna exports to the EU market this month reached just over 15 million USD, down 19% over the same period. Calculating the cumulative total in the first 10 months of the year, tuna exports to the EU still increased by 1%, reaching more than 143 million USD (InnovativeHub, 2023).

Pangasius

By the end of November this year, pangasius export turnover reached nearly 1.7 billion USD, still down 26% over the same period last year. Average export prices have also decreased

in main markets, especially the US and China, leading to lower pangasius export value compared to 2022. However, there are positive signs in fish exports. Pangasius fish fillets in some markets such as China, Mexico, Canada, Brazil, England... In addition to the main product which is pangasius filets, by-products such as dried pangasius bladder and pangasius patties are attracting attention from many markets. markets such as the US, China, Malaysia, and Singapore (Khoi, 2023).

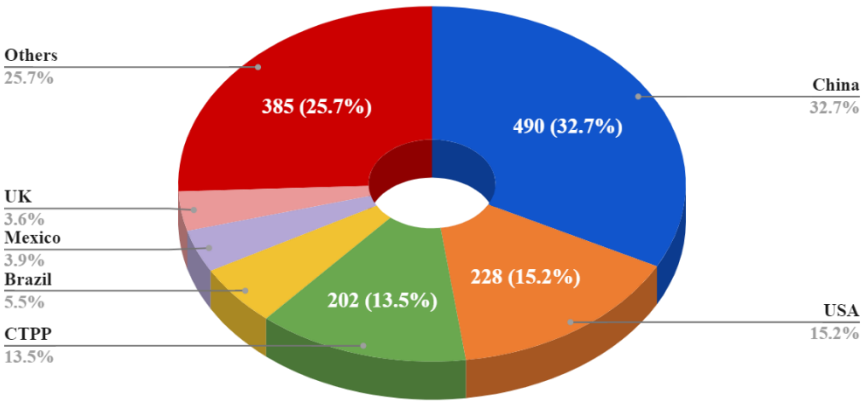

Figure 5. Pangasius export market structure in the first 10 months of 2023

Source: VASEP

In October, China continued to be the leading market importing Vietnamese pangasius and recorded positive growth. Pangasius export value reached about 56 million USD, equivalent to the previous month, and increased 15% over the same period last year. However, by the end of October, pangasius exports to this market still decreased by 23%, reaching more than 490 million USD. (Khoi, 2023)

2.3. Literature review on forecasting fishery export value

Time Series Analysis is one of the most widely used applications of data science (Kotu & Deshpande, 2018). It is a type of predictive analytics that forecasts the value of a variable in future occurrences based on history. There are several time series forecasting techniques, however, the choice of algorithm is contingent upon the specific business problems and available data. Besides, the appropriate time series model will also depend on the data pattern of the series.

Some domestic studies such as Vo T.V. (2012) have used simple linear regression models and ARIMA models for forecasting, with ARIMA proving to be the more effective choice. To Kim Hong et al. (2017) also employed regression and ARIMA models to forecast Vietnam's pangasius exports to the United States of America (US), finding ARIMA suitable with a 5% significance level and a 2.13% MAPE. Lieu's (2017) study emphasizes the suitability of the Holt-Winters exponential smoothing method, particularly with additive series, for forecasting electricity demand in the Phu Vang district. Additionally, Amrit et al. (2015) explored time series analysis methods, including simple exponential smoothing, Holt exponential smoothing,

Winters exponential smoothing, and average forecasting. While exponential smoothing models generally performed well, the study suggested considering additional models for more accurate forecasting results.

However, this paper mainly focuses on using Holt-Winters Exponential Smoothing in time series forecasting. Several studies have investigated the effectiveness of Holt-Winters exponential smoothing for multiplicative models in forecasting the export value of marine products. The work of Riansut, W. (2022) employed the Holt-Winters Exponential smoothing approach to forecast the frozen shrimp export values. Dung T.T. et al. (2014) advocate for the efficacy of the combined Holt-Winters and decomposition model in predicting pangasius export volume. Kuldilok et al. (2013) used two methods: Holt-Winters exponential smoothing and autoregressive integrated moving average (ARIMA) methods to forecast the monthly aggregate of tuna export value in Thailand. With MAPE for the exponential smoothing (8.579%) less than that of the ARIMA model (9.268%), the Holt-Winters exponential smoothing model fits the data better than the ARIMA model. Tirkes and Celebi (2017) contribute insights by comparing trend analysis, decomposition, and Holt-Winters models, with superior performance observed in the latter two models. Moreover, Fabson and Oyatoye (2013) explore the application of the Holt-Winters model in managing material and product flows, showcasing its effectiveness in reducing the bullwhip effect and amplification for heightened profitability.

Previous studies provide a foundation for the research on fishery export value forecasting, emphasizing the potential of the Holt-Winters exponential smoothing method and the need for tailored applications in the Vietnamese context. While several studies have successfully applied this method to capture seasonal and trend components, challenges related to parameter estimation and data preprocessing need to be carefully addressed.

3. Research methodology and data

3.1. Forecasting Method

Exponential smoothing methods use weighted averages of past observations to forecast, with the weights decaying exponentially as the observations get older.

Holt-Winters method is an exponential smoothing method that adjusts for trend and seasonality. This forecasting method is suitable for time series data with both trend and seasonal components. To forecast the time series, using the Holt-Winters exponential smoothing method, the components of the time series at each point of time including the level, trend, and season are estimated separately. These estimates are then combined to make the final forecast value for the time series. Based on the interaction between seasonal and trend components, time series data are divided into additive and multiplicative series, and the Holt-Winters exponential smoothing method applied to each type is different. Additive time series are those that the seasonal pattern repeats year after year with almost unchanged magnitude, while for multiplicative series, the seasonal pattern repeats year after year with increasing or decreasing magnitude. In this study, as the seafood export value has the characteristics of a multiplicative series, the Holt-Winters exponential smoothing method is used to forecast this type of time series. This method consists of four main steps and is represented by four general equations, depending on the characteristics of the model generated from the data series.

- Step 1: Calculate the exponential smoothing smoothed value of the series at time t to estimate the level at time t:

$$L_t = \alpha \frac{Y_t}{S_{t-s}} + (1-\alpha)(L_{t-1} + T_{t-1})$$

- Step 2: Estimate trend component (slope) at time t:

$$T_t = \beta(L_t - L_{t-1}) + (1-\beta)T_{t-1}$$

- Step 3: Estimate seasonal component at time t:

$$S_t = \gamma \frac{Y_t}{L_t} + (1-\gamma)S_{t-s}$$

- Step 4: Calculate the h-period ahead forecasted value:

$$\widehat{Y_{n+h}} = (L_n + h \times T_n) \times S_i$$

In which:

n: the last observation of the time series

Y_t: Observed value of time series at time t

L_t: The average value of estimation

T_t: The trend value of estimation

S_i: Estimated seasonal component for the period to be forecasted

i = n + h - s (h < s)

i = n +h - 2s (h >s)

s: number of seasons in a year

α: exponential smoothing coefficients

β: estimated trend smoothing coefficient

γ: estimated seasonal smoothing constant

$$0 < \alpha, \beta, \gamma < 1$$

In Holt-Winters exponential smoothing method, α, β, and γ are chosen so that they minimize RMSE. These smoothing coefficients will be calculated by EVIEWS.

3.2. Method to check for the model's accuracy

Once the model is specified, its performance attributes should be validated by comparing its predictions with historical data related to the process it was designed to forecast. The crucial factor in assessing the quality of a forecast is accuracy, making it the primary consideration. The forecast aims to minimize errors.

In this research, the following criteria are used to check for the adequacy of the forecasting model: MAPE and graph comparison of the actual series with the forecast series.

$$MAPE = \frac{1}{n} \sum \left| \frac{e_t}{Y_t} \right|$$

where Y_t is the actual value at the time t; e_t is residual at the time t; n is the total number of the time periods.

The Mean Absolute Percentage Error (MAPE) proves particularly useful for comparing forecast accuracy across different items or products since it measures relative performance. MAPE is a commonly used accuracy measure in quantitative forecasting methods. Interpreting MAPE values, if the calculated value is under 10%, it is considered accurate forecasting, between 10% and 20% is considered good forecasting, between 20% and 50% is acceptable forecasting, and over 50% suggests inaccurate forecasting (Lewis, 1982).

For the graphical comparison, we compare the forecasted and actual values, to see the differences and whether the forecasted series traces along the turning points of the actual data.

3.3. Data

The time series data comprises 81 observations from January 2017 to September 2023, compiled from the website of the General Statistics Office of Vietnam. The data will be synthesized in Excel and processed in EVIEWS 12.

Table 2. Data explanation

Variable	Meaning	Unit	Data Source
fish	Export value of fishery products in Vietnam	1000 USD	General Statistics Office of Vietnam *https://www.gso.gov.vn/xuat-nhap-khau/*

Source: The authors

4. Results and discussion

4.1. In-sample estimation

4.1.1. Data patterns

With the help of EVIEWS, we have the following descriptive results:

Table 3. Descriptive statistics

Index	Value
Number of Observations	81
Mean	747060.4
Median	761922.1
Maximum	1126139
Minimum	368335.9

Standard Deviation	146822.4

Source: Compiled in EVIEWS

From the descriptive statistics, the series of export value of fishery products in Vietnam has 81 observations, with a mean value of 747,060.4 thousand USD, and a median value of 761,922.1 thousand USD. The highest fishery export value in Vietnam is 1,126,139 thousand USD (recorded in April 2022) and the lowest level is 368,335.9 thousand USD (recorded in February 2019).

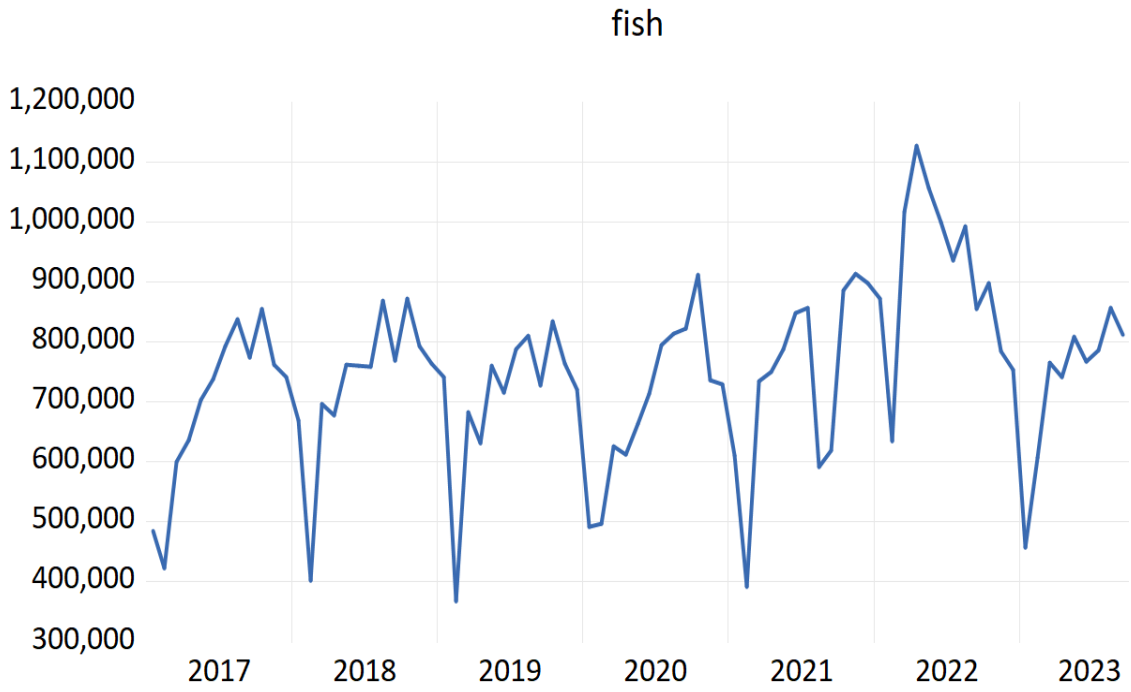

Figure 6. Vietnam's fishery export value from 2017 to September 2023

Source: Compiled in EVIEWS

As observed in Figure 6, the data fluctuates over the period and the trend of the series is not significant. Additionally, there seems to be a seasonal pattern repeating year after year, as the fishery export value decreases annually in February and then increases significantly throughout the year. This conclusion is also shown in the seasonal graph (Figure 7), where the red line represents the means by season, and theoretically, if these lines show greater variation, it indicates a clearer seasonal pattern in the series.

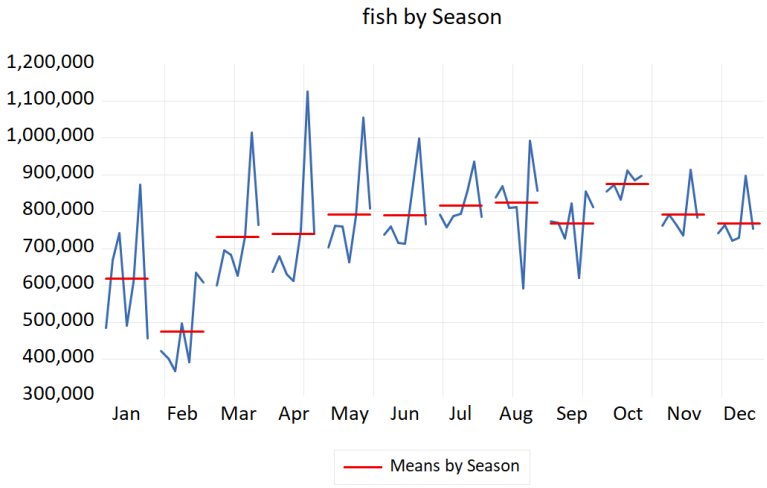

Figure 7. Export value of fishery products in Vietnam by season

Source: Compiled in EVIEWS

To confirm seasonality in the series, the team uses the Kruskal-Wallis test. With a p-value of 0.0001, the test statistic is significant at any level. Therefore, the series has seasonal component.

The correlogram of fishery export value (Figure 8) shows that the data series are significant at lag 1, 12, and 24, also indicating a strong seasonal pattern.

Date: 12/08/23 Time: 03:17
Sample: 2017M01 2023M09
Included observations: 81

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.565	0.565	26.802	0.000
		2	0.333	0.021	36.247	0.000
		3	0.143	-0.078	38.008	0.000
		4	0.003	-0.079	38.009	0.000
		5	0.004	0.072	38.010	0.000
		6	-0.109	-0.161	39.075	0.000
		7	-0.085	0.044	39.733	0.000
		8	-0.171	-0.157	42.419	0.000
		9	-0.051	0.184	42.665	0.000
		10	0.078	0.095	43.248	0.000
		11	0.213	0.191	47.604	0.000
		12	0.404	0.229	63.501	0.000
		13	0.175	-0.298	66.542	0.000
		14	0.023	-0.170	66.594	0.000
		15	-0.069	0.006	67.078	0.000
		16	-0.101	0.006	68.135	0.000
		17	-0.068	0.041	68.621	0.000
		18	-0.183	-0.114	72.195	0.000
		19	-0.099	0.158	73.251	0.000
		20	-0.103	0.053	74.429	0.000
		21	-0.029	-0.062	74.526	0.000
		22	0.064	-0.048	74.995	0.000
		23	0.175	0.119	78.538	0.000
		24	0.268	-0.006	87.017	0.000
		25	0.076	-0.110	87.702	0.000
		26	-0.046	-0.092	87.965	0.000
		27	-0.182	-0.094	92.102	0.000

Figure 8. Correlogram of series "fish"

Source: Compiled in EVIEWS

4.1.2. Estimation Result

As the series has seasonality, it is appropriate to use the Holt-Winters exponential smoothing method to estimate in-sample observations. The result will then be used to evaluate the predictive power of the forecasting method.

Table 4. Estimation results

Sample: 2017M01 2023M09		
Included observations: 81		
Method: Holt-Winters Multiplicative Seasonal		
Original Series: FISH		
Forecast Series: FISHSM		
Parameters:	Alpha	0.6400
	Beta	0
	Gamma	0
End of Period Levels:	Mean	791127.2
	Trend	3575.571

Source: Compiled in EVIEWS

Calculated from the estimated results, the MAPE of the model is 8.618%. As mentioned above, the MAPE of the Holt-Winters exponential smoothing method is lower than 10%, indicating good forecast performances of the fishery export value in Vietnam.

Figure 9 plots the original time series as a blue line, with the forecasted values as a red line. It can be observed that the in-sample forecasts align quite favorably with the observed values, despite exhibiting a slight lag compared to the observed values. However, during periods of unusual changes (from 2020 to 2022), the forecast series exhibits larger errors compared to other periods.

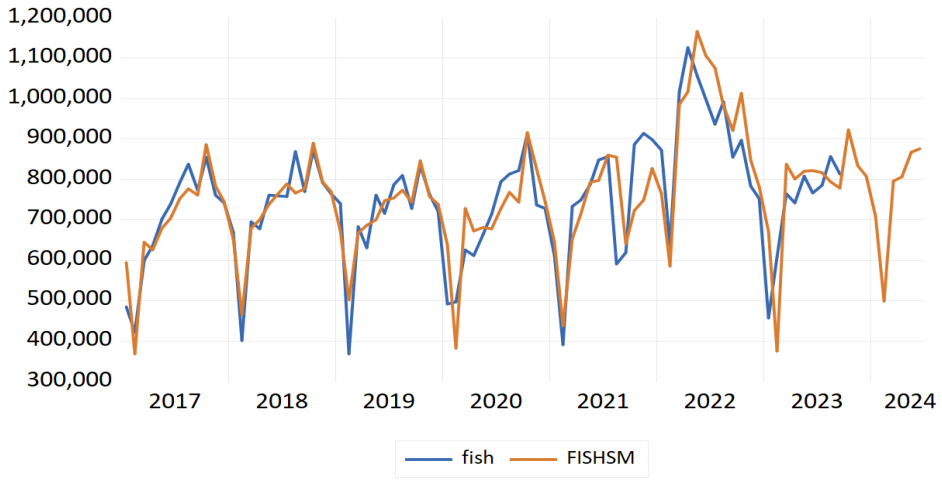

Figure 9. Compare actual and forecasted value

Source: Compiled in EVIEWS

4.2. Out-of-sample: Forecasting Results

Since the Holt-Winters exponential smoothing model fits the fishery export data, we can use this method to forecast export values of Vietnam's fishery products for the next nine months out-of-sample (from October 2023 to June 2024). The forecasted values are given in Table 5. The forecasted values indicate that seafood export value in Vietnam is expected to fluctuate and decrease compared to the same period last year.

Table 5. Forecasting results

Month	fish	Month	fish
2023M10	922614.1	2024M03	795953.9
2023M11	834008.9	2024M04	806299.2
2023M12	808446.9	2024M05	866629.4
2024M01	709251.3	2024M06	876318
2024M02	498152.5		

Source: Compiled in EVIEWS

4.3. Discussion

As the most recent observation was recorded in September 2023, forecasting for October and November 2023 is crucial for short-term assessments of Vietnam's seafood exports due to several key factors. Firstly, in economics, it may take some time for the impacts of economic variables to be reflected in time series data. Events or economic changes in November 2023 may not immediately affect the data. Therefore, forecasting for these months can provide information about the long-term effects of these eventsSecondly, these forecasts help capture unforeseen short-term changes, such as political shifts or weather fluctuations, which can significantly impact seafood exports. Additionally, short-term forecasting is valuable for risk management and day-to-day planning, enabling timely decision-making. Lastly, continuous monitoring and evaluation are essential to adapt to dynamic market conditions. Despite inherent limitations, short-term forecasting remains a foundation for predicting and managing short-term economic fluctuations in the seafood export industry.

The forecast for Vietnam's fishery export values from October 2023 to June 2024 demonstrates significant fluctuations. The values start at 922.61 million USD in October. Then, it occurs a drop in February 2024, explained by seasonality, but the trend reverses in March and continues to rise through June, reaching 876.38 million USD. These variations reflect the dynamic nature of the fishery export market during this period.

Vietnam's fishery exports are expected to reach 10,000 million USD in 2024, according to the VASEP. This represents an 11% increase over the expected export value of 9,000 million USD in 2023 (VNS, 2023).

The growth in fishery exports in 2024 is expected to be driven by several factors. Firstly, the ongoing global economic recovery is expected to boost the demand for seafood products (IMF, 2023). Secondly, Vietnam's three primary seafood export markets, including the US, EU, and China, are all projected to elevate their seafood imports in the coming year (Chu, VnEconomy, 2023). Additionally, the strong performance and emphasis on high-value seafood products like shrimp, tuna, and pangasius by Vietnamese seafood producers align with the high demand in key export markets, further contributing to the growth (VASEP, 2023).

However, several challenges could affect Vietnam's fishery exports in 2024. Firstly, rising production costs, attributed to factors like increased fuel and feed prices, are presenting a concern for Vietnamese seafood producers (Chanh, 2023). These higher production expenses may render Vietnamese seafood products less competitive in the global marketplace. Secondly, trade barriers have been imposed by certain countries on Vietnamese seafood products in recent years, posing obstacles to exports in these markets. Lastly, geopolitical tensions, such as the ongoing conflict in Ukraine, could disrupt global supply chains and impact demand for seafood products (Vo T. T., 2023).

5. Conclusion

In conclusion, the forecast for Vietnam's fishery export values from October 2023 to June 2024, using the Holt-Winter exponential smoothing method with an 8.548% MAPE, indicates a market characterized by substantial fluctuations. The values exhibited significant variations during this period, peaking at 922.61 million USD in October 2023, and showing a seasonal drop in February 2024 before rebounding and reaching 876.31 million USD in June.

Furthermore, research shows that Vietnam's fishery exports are expected to reach 10 billion USD in 2024, reflecting an 11% increase over the expected export value of 9 billion USD in 2023. This optimistic projection is attributed to the ongoing global economic recovery, expected growth in seafood demand, and the commitment of Vietnamese seafood producers to high-value products like shrimp, tuna, and pangasius.

However, the industry faces challenges, including rising production costs due to factors like fuel and feed prices, trade barriers imposed by certain countries, and potential disruptions from geopolitical tensions. This research underscores the need for adaptability and strategic planning in Vietnam's fishery export sector as it navigates the dynamics and challenges of the coming year. Moreover, it is extremely important that the Government, relevant ministries, businesses, as well as investors, in the industry need to have objective views and assessments of the challenges and difficulties that need to be overcome to take advantage of future opportunities, not only in the short term but also in the long term. As the export value of fishery products in Vietnam continues to be a significant driver of economic growth and development, ongoing research and monitoring are essential to adapt to changing circumstances and ensure the sustainability and resilience of this vital sector.

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