Economic Analysis of Fish Exports in ASEAN Countries

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Abstract. This research aims to analyze the determinants of fish exports in ASEAN countries from 2012 to 2021. The data used in this research were obtained from official sources that pertain to fish exports in each ASEAN member country. A panel data regression approach was implemented as the analysis method. Gross Domestic Product (GDP), currency exchange rate (ER), FP (fish production), Total population (Pop), and number of ports (NP) were the variables that were observed. The analysis results revealed that GDP, currency exchange rate, and fish production variables significantly influenced fish exports from ASEAN countries. Nevertheless, the population (JPNTE) variables and number of ports (JP) were not found to have a substantial impact on fish exports. These findings suggest the importance of macroeconomic and production factors in determining fish export performance, while factors such as population and number of ports did not significantly influence.

1 Introduction

ASEAN countries possess extensive and diverse sea waters, encompassing territorial seas, exclusive economic zones (EEZ), and other special water areas. This area has abundant marine resources, such as fish, oil and gas, minerals and other biological resources. In the context of marine resource wealth, the ASEAN region holds significant importance on a worldwide scale. The region's waters are strategically important in international trade, transportation, and energy security. Besides that, marine resources in the ASEAN region also make a major contribution to the economic sector and environmental sustainability in member countries [1]. The wealth of marine resources in the ASEAN region creates great potential for sustainable economic development, tourism, the fishing industry, and the energy sector. The Southeast Asia region also occupies a crucial position in the world economy, and the fisheries sector has emerged as an important pillar that can promote a favorable contribution to regional economic growth. ASEAN's key role in the global economy is proven through the immense potential of its fisheries sector. Economic sustainability and community welfare in this region are heavily influenced by how ASEAN countries utilize and manage fisheries resources.

The significant potential of the fisheries industry exerts a favorable influence on economic growth, serving as the primary impetus for ASEAN countries' active engagement

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in international trade. As global demand for fishery products increases, these countries position themselves as major players in providing fish supplies to meet world needs [1]. The Asian region has also occupied a superior position as a region that contributes to the largest fish production in the world. Particularly, the marine and fisheries sectors in the ASEAN region account for 18.3% (30.6 million tons) of total world fish production. In the global fisheries ecosystem, the dominance of countries such as Indonesia, the Philippines, Vietnam, and Thailand collectively forms an important landscape. The achievements of the ASEAN region are not only limited to high production volumes but are also reflected in the economic value generated by the fisheries sector. Trade in the fisheries sector significantly stimulates the economic growth of countries in the ASEAN region [2]. The fisheries sector is identified as a major force that can support the economy and positively contribute to regional economic growth. Despite economic fluctuation, the fisheries sector could demonstrate remarkable resilience, achieving growth rates of 11.3% in Indonesia and 9.4% in Malaysia. Table 1 shows the fish production in ASEAN from 2015-2021.

Table 1. Fish Production in ASEAN (tons)

Countries	Years						
	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Brunei Darussalam	4,353.1	14,239.6	13,496.0	14,812.0	14,623.6	16,591.1	20,062.9
Cambodia	753,405.0	802,450.0	856,320.0	910,155.0	908,508.0	936,300.0	856,400.0
Indonesia	22,384,950.3	22,583,433.9	23,064,370.0	22,927,660.3	22,618,341.1	21,786,056.7	21,813,412.8
Lao PDR	158,600.0	164,000.0	168,869.0	179,208.0	187,701.0	200,021.0	206,008.0
Malaysia	2,003,019.2	1,992,258.1	1,901,885.5	1,855,008.9	1,877,376.2	1,791,061.8	1,754,209.0
Myanmar	2,970,100.0	3,090,034.3	3,204,303.3	3,168,575.1	3,033,272.8	3,122,348.0	2,594,956.9
Philippines	4,502,146.0	4,227,937.8	4,126,941.2	4,125,796.5	4,188,402.0	4,237,685.8	4,114,594.4
Singapore	8,161.3	7,346.4	6,943.8	7,011.4	7,249.1	5,184.4	5,549.9
Thailand	2,427,432.1	2,494,167.3	2,388,032.5	2,458,069.1	2,490,448.9	2,601,509.3	2,402,021.3
Vietnam	6,336,087.6	6,659,520.0	7,146,070.5	7,509,001.5	7,941,250.3	8,187,491.7	8,289,524.0

Additionally, in the global market, the ASEAN region's countries are crucial, as fishery products are the primary source of fish exports for numerous countries, such as the United States, Australia, China, and Japan. The fish trade dynamics in this region are characterized by a positive trend, with a substantial increase from year to year. Although the ASEAN region's total fish exports decreased by 10,918.0 million US dollars in 2015, this trend may be influenced by various factors, including global market fluctuations, trade policies, or internal issues in several member countries.[3] However, the subsequent period was characterized by the resurgence of the fisheries sector in ASEAN, as evidenced by the consistent and constant increase in fish exports. The region's robust competitiveness and expanding production capacity were evident in the total value of fish exports in 2021, which amounted to 13,721.0 million US dollars. This increase is a testament to the fisheries sector's immense potential in ASEAN, not only as a source of substantial export income but also as a catalyst for regional economic growth. Sustainable economic growth in the ASEAN region, bolstered by a robust fisheries sector, is essential for developing economic stability and prosperity in communities in the region. Consequently, fish exports from

ASEAN are not only indicative of a substantial economic potential at the regional level, but they also play a crucial role in the global trade of fishery product. The novelty of this research is that it includes variables for the amount of fish production and the number of ports in the research model.

2 Research method

The objects of this research are ASEAN member countries including Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, The Philippines, Singapore, Thailand and Vietnam from 2012 until 2021. The panel regression model in this research is as follows [4]:

$$Y = \alpha + \beta_1 GDP_1 + \beta_2 XPop + \beta_3 ER + \beta_4 FP + \beta_5 NP + \varepsilon_{it} \tag{1}$$

where, Y was Exports; GDP was gross domestic product; ER was exchange rate; FP was fish production; Pop was total population; NP was number of ports

This testing process aimed to ensure whether the overall regression model had significance. The steps in carrying out this test are as follows:
H0: $\beta 1 = \beta 2 = 0$, meaning that together, the independent variable does not influence the dependent variable.
H1: $\beta 1 \neq \beta 2 \neq 0$, meaning that together, there is an influence of the independent variable on the dependent variable.

This test was carried out by comparing the F-count value calculated from the data with the F-table value in the F distribution at a predetermined significance level. If the F-count value is greater than the F-table value, the null hypothesis (H_0) can be rejected. This indicates that together, at least one independent variable has a significant effect on the dependent variable in the regression model. In other words, there is sufficient evidence to state that the regression model as a whole has significance in explaining the variability of the dependent variable. The t-statistic test, also known as the partial test, is a statistical tool used to evaluate the relative significance of each independent variable in a regression model. The goal is to determine whether each independent variable significantly influences the dependent variable, ignoring the other variables in the model. Using E-Views 9.0 software for estimation, these measurements can be seen directly from the model estimation output. The calculated t value for each independent variable will be available in the output. Next, this value can be compared with the critical value from the t-distribution table to determine the statistical significance of independence. International trade is a form of economic cooperation between two or more countries to satisfy their domestic needs. More than that, this concept includes various forms of economic cooperation between individuals, individuals and governments or countries, as well as between countries and other countries.

International trade is a collection of business operations that multinational corporations engage in from one country to another, involving border crossings to exchange products and services, capital, labor, technology, and trademarks [5]. In addition to the physical exchange of products and services between countries, international trade entails interacting various economic, social, and political elements. Not only physical products are traded, but also capital, labor, technology, and trademarks. International trade also entails multinational corporations operating in global markets by utilizing national borders to conduct business activities. Within the framework of international trade, multinational companies play a key role as agents facilitating the flow of goods and services between countries. They engage in export and import activities, transfer capital abroad, employ laborers from various countries, transfer technology, and introduce their trademarks to the global market. Hence, international trade is not limited to exchanging tangible products; it also encompasses transferring

knowledge, expertise, and added value between the participating countries. Salvatore (2014) formulated a simple model of international trade as Figure 1.

The figure above illustrates international trade between countries A and B. In this context, country A acts as an exporting country, while country B is an importing country. This international trade arises because there is an excess supply in country A and excess demand in country B for a commodity. For example, the price of a commodity in country A is Pa, while it is Pb in country B, assuming ceteris paribus. On the international market, the price of this commodity, symbolized by P*, tends to be between Pa and Pb. This causes country A to experience excess supply, as the price P* is lower than in country A. On the other hand, in country B, commodity prices are higher compared to international market prices, resulting in excess demand [5] Thus, there is an incentive for country A to export these commodities to country B, while country B will tend to import these commodities from country A. This process creates international trade flows that benefit both countries, allowing them to exploit their comparative advantages and meet their consumers' needs more efficiently. According to Krugman (2003), the main motivation behind implementing international trade is the existence of variations between countries, which can be exploited to gain profits through the trade process. Trade between countries brings economic benefits since not all countries have similar production equipment and economic conditions, both in quantity and quality, which results in differences in production costs. Consequently, a country will be more profitable to import a commodity if the production costs of the commodity are excessive in that country. [6] Conversely, export activities may be implemented to capitalize on a nation's surplus in commodity supply.
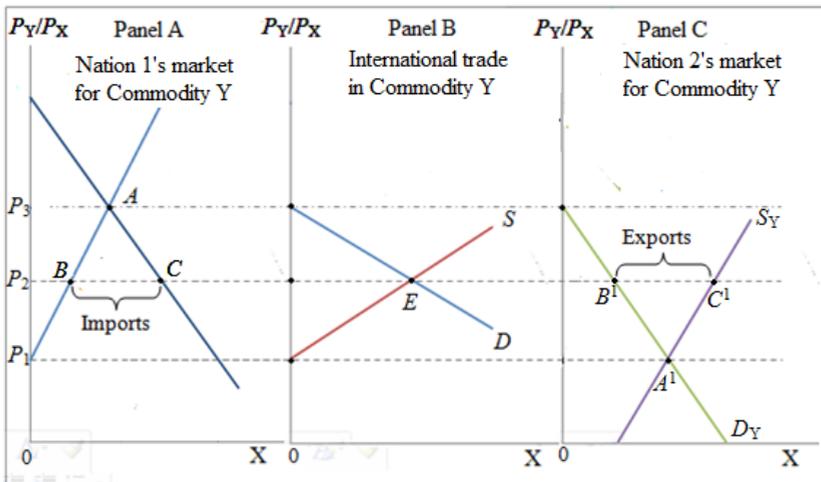

Fig. 1. International trade process curve [17]

3 Results and discussion

As evidenced by the Chow test results, the value of Prob cross-section fixed effect F was 0.000, which is smaller than $\alpha = 0.05$. Consequently, it can be inferred that the Fixed Effect model or method was more suitable than the Common Effect model. The Hausman test was also implemented to ascertain the optimal approach between Fixed Effect and Random Effect. The Hausman test results revealed a probability value of 0.6336, greater than $\alpha = 0.05$. As such, it can be concluded that the Random Effect model or method was more appropriate. It then proceeded with the Lagrange Multiplier (LM) evaluation to determine the most effective method between the Common Effect and Random Effect. As the probability value of 0.000 was smaller than $\alpha = 0.05$, as demonstrated by the LM test results, the Random

Effect model or method was more appropriate for this analysis. The following results were acquired through regression testing using the Random Effect method:

Table 2. Panel Data Regression Analysis using the Random Effect Method

Variable	Coefficient	Std. Error	T-Statistic	Prob
C	3779.305	2366.060	1.597299	0.1136
GDP	12.86852	5.751457	2.237437	0.0276
ER	0.086513	0.034349	2.518616	0.0135
FP	7.95E-05	3.60E-05	2.208995	0.0296
Pop	-2.25E-06	1.43E-06	-1572026	0.1193
NP	-1.010663	0.577982	-1.748606	0.0836

Based on the results of the panel data regression analysis in the table above, the following regression model was obtained:

$$Y = 3779.305 + 12.86852GDP + 0.086513ER + 0.0000795FP_{\square} \\ - 0.00000225Pop - 1.010663NP_5$$

where, Y was exports; GDP was gross domestic product; ER was exchange rate; FP was fish production; Pop was total population; and NP was number of ports

Using the panel data regression equation, the subsequent data was acquired. If it is assumed that the values of the variables X_1, X_2, X_3, X_4, X_5 were constant or equal to zero, the value of variable Y was 3779.305. The regression coefficient on the GDP variable was 12.86852 and was positive. It denotes that if the GDP variable experiences a significant increase of 1 point while the other variables have a fixed value, the GDP variable will increase the value of the export variable by 12.86852. The exchange rate variable's regression coefficient was 0.086513, which was positive.

This indicates that if the exchange rate variable experiences a significant increase of 1 point and the other variables remain constant, the export variable's value will increase by 0.086513. The regression coefficient for the production variable was 0.0000795, indicating a positive relationship. This means that if the production variable increases by 1 point while holding other variables constant, the export variable will increase by 0.0000795. The regression coefficient for the Pop variable was negative, with a value of 0.0000025. [7] This implies that if the Pop variable experiences a significant increase of 1 point and the other variables remain constant, the export variable will be reduced by 0.0000025. Lastly, the regression coefficient for the JP variable was 1.010663 and was negative.

This indicates that if the JP variable experiences a substantial increase of 1 point while the other variables remain constant, the export variable will be reduced by 1.010663. The coefficient of determination value is between zero and one. If the coefficient of determination is closer to 1, the influence of the independent variable on the dependent variable is higher. Based on the coefficient of determination test results, the R^2 (Adjusted R Square) value from the regression model was used to determine how much ability the independent variable had in explaining the dependent variable. The R^2 value of 0.293 means that 29.3% of the export variation could be explained by variations in the five independent variables (GDP, exchange rate, fish production, Population, and Number of Port). Meanwhile, the remainder (100% - 29.3% = 70.7%) were influenced by other variables outside this research. Furthermore, the Prob. (F-Statistics) value was 0.000 < 0.05, and the F-count value of 9.230 > F-table of 2,310, which indicates that the independent variables in the form of GDP, exchange rate, fish production, total population, and number of ports influenced the dependent variable, i.e., exports. Therefore, it can be seen that there was a significant simultaneous influence of the independent variables, i.e., GDP, exchange rate, production, JPNTE, and JP, on the dependent variable, namely exports.

Based on Table 2 above, the regression coefficient on the GDP variable was 12.86852, indicating a positive result on the export variable. This means that if GDP increases significantly by 1 percent, and all other variables remain constant, the value of the export variable is estimated to increase by 1286.852%. The results of random effect testing showed that the GDP variable significantly impacted the export variable. Furthermore, the results of the partial test (t-test) revealed that the GDP variable significantly impacted the export variable. The Prob value of the GDP variable was 0.0276, smaller than 0.05. Then, the calculated t-value obtained was 2.237, greater than the t-table (1.985), denoting that the GDP variable had a partially significant influence on the export variable. In fact, Gross Domestic Product (GDP) is a metric employed to evaluate the monetary worth of all commodities and services generated inside a nation's territorial limits within a specific timeframe, often one year. It is an essential metric in economics used to evaluate a nation's well-being and economic expansion. The significance of GDP in an economic context lies in its ability to reflect the entirety of economic activity, indicate the rate of economic expansion or contraction, and offer insights into the magnitude and robustness of a nation's economy. A high GDP growth rate is a reliable measure of economic well-being [8].

However, a decrease in GDP or sluggish growth can indicate economic challenges, such as a recession or decelerating growth. In addition to serving as a measure of overall economic well-being, GDP is closely interconnected with several other facets of the economy, such as exports. Robust economic expansion, as the Gross Domestic Product (GDP) indicates, can enhance individuals' ability to buy goods and services, hence stimulating demand for domestic and export products. In contrast, slow or unfavorable economic growth might impede domestic demand and diminish the country's capacity to acquire imported and exported commodities. Mankiw (2016) stated that when a country's GDP per capita is high, it tends to have greater purchasing capacity, making it a potential market for marketing a commodity. This is likely to increase the ability of importing countries to purchase fish from ASEAN countries. With increasing purchasing power, demand for products, including fish, may increase, providing greater trade opportunities between ASEAN countries [9].

The table above also displays that the regression coefficient on the exchange rate variable was 0.086513, with a positive value. If the exchange rate variable experiences a significant increase of 1 percent and all other variables remain constant, the value of the export variable is estimated to increase by 8.6513%. This indicates a positive relationship between the exchange rate and exports. Furthermore, the statistical test results showed that the exchange rate variable had a Prob value of 0.013, smaller than the significant level (0.05). In addition, the t-count value obtained was 2.518, greater than the t-table value (1.985) at the 0.05 significance level. Thus, based on the results of the statistical tests, it can be said that the exchange rate variable significantly affected the export variable. The exchange rate is the relative price between two currencies that exhibits how many units of one country's currency can be exchanged for one unit of another country's currency. In simple terms, a currency exchange rate measures the value of one currency in terms of another currency. This rate reflects the relative strength between two currencies in the foreign exchange (forex) market. Fluctuations in currency exchange rates can significantly impact international trade and a country's economy. [10] Exchange rate of a foreign currency is the amount of domestic money issued for a certain amount of currency [11].

This exchange rate can change from time to time, and the changes that occur can be known as appreciation, which refers to an increase in the value of a currency, and depreciation, which refers to a decrease in the value of a currency. Appreciation occurs when a country's currency strengthens, or its value rises relative to another country's currency. In the context of exchange rates, the amount of foreign currency that can be purchased with one unit of domestic currency is less. On the other hand, depreciation occurs when a country's currency weakens or its value falls relative to another country's currency, so the amount of

foreign currency that can be purchased with one unit of domestic currency becomes greater. Changes in exchange rates can be influenced by various economic factors, including monetary policy, international trade conditions, inflation rates, interest rates, and political and geopolitical factors [12].

Currency exchange rate fluctuations significantly impact a country's economy, such as international trade, investment, and overall economic stability. Moreover, the regression results revealed that the regression coefficient on the production variable was 0.0000795, with a positive value indicating a positive relationship between production and exports. In other words, if other variables remain constant, the value of the export variable is expected to increase by 0.00795%. Then, the production variable obtained the Prob value of 0.029, smaller than the significant level (0.05). In addition, the calculated t-value of 2.208 was greater than the t-table value, corresponding to the selected significance level (1.985). Thus, the production variable had a noteworthy influence on the export variable. Put simply, the hypothesis (H3) stating that production variables significantly affect export variables was accepted. Production is, in fact, a process or activity that involves converting input into output in the form of goods or services. It includes all the steps necessary to create or produce goods or services desired by consumers or users [13].

The production process can occur in various contexts, from the manufacturing industry to the service sector. In an economic context, production is vital, as it is one of the main aspects of creating added value and economic prosperity in a country. Production involves using natural resources, labor, technology, and capital to produce goods and services that meet society's needs and wants. The production process also plays a key role in shaping a country's economic structure and determining a country's economic specialization in the global market. On the basis of Table 2 above, the regression coefficient on the Pop variable was 0.0000025, exhibiting a negative relationship between the Pop variable and exports. If the Pop variable experiences a significant increase of 1 percent and the other variables remain constant, the value of the export variable is estimated to decrease by 0.00025%. Next, the JPNTE variable had the Prob value amounting to 0.1193, higher than the significant level (0.05), while the t-count value obtained a value of -1.572, smaller than the t-table value (-1985) [9].

This indicates no significant influence between the Pop and the export variables since the t-statistic value was below the critical value. Therefore, the hypothesis (H4), which stated that the population of the export destination country has a significant effect on exports, was rejected. Population is the total number of individuals living in a region or country at a certain time. The population is usually calculated by combining all individuals living in the territory, including citizens and foreign residents living permanently or temporarily. A large population in a country can create a large domestic market for goods and services. This can encourage the growth of domestic industry to meet the needs of local consumers, where an increase in a country's population can promote an increase in demand for various commodities and consumer goods. The greater the population, the greater the demand for food, clothing, housing, health services, education, transportation, and other goods and services. This need creates a large and potential domestic market for local and foreign producers. Countries unable to meet local consumers' needs for a commodity may be forced to import these goods or commodities from other countries. This could impact increasing imports and lead to a trade deficit, especially if domestic demand exceeds domestic production. When supply cannot meet demand, this can trigger an increase in domestic prices due to a surge in demand that is not balanced by an increase in local production. The consequence of this price increase can be inflation, which is detrimental and reduces the population's purchasing power, thus affecting the overall level of welfare and economic stability [14].

Finally, the regression results uncovered that the regression coefficient on the NP variable was 1.010663, showing a negative relationship between NP and export variables. If the NP variable experiences a significant increase of 1 percent and the other variables remain constant, the value of the export variable is estimated to decrease by 101.0663%. Also, the Prob value of the NP variable was equal to 0.0836, more significant than the general significant level (0.05). In comparison, the t-calculated value was -1748, smaller than the t-table value corresponding to the significant level (-1.985), indicating no significant influence of the number of ports and piers on exports. Hence, the hypothesis (H5) suggesting that the number of ports and piers significantly affects the export variable was rejected. Related to that, a port is a maritime facility that functions as a place for stopping, loading, unloading and storing ships and managing goods and passengers entering and leaving the country. Ports have piers, storage warehouses, security facilities, and loading and unloading equipment to support trade and maritime transportation activities [11].

Ports often become central points for regional and international economic activities because they are the main gateway for imports and exports of goods. The pier is also part of the port that is used for ships to dock. [15]This structure allows ships to stop temporarily and carry out loading and unloading activities of goods and passengers.[3] The pier usually consists of a platform reinforced with pillars or a concrete structure that supports the ship's weight and cargo. In addition, the pier is equipped with facilities, such as cranes and distribution systems, to facilitate the loading and unloading process. Piers can be fixed docks connected directly to land or floating docks on the water. Ports and piers are the main places where goods to be exported are loaded onto ships. Piers provide the infrastructure for loading and unloading goods from land vehicles or railways to ships transporting these goods to international markets. For that reason, investment in developing ports and piers can produce long-term benefits for a country's economy. Providing modern and efficient facilities can attract more investment, increase employment opportunities, and encourage economic growth through increased export activity. Modern and efficient ports and adequate piers are essential to ensure good accessibility to international markets. A good port can attract more cargo ships from various countries to dock and load goods for export [16].

4 Conclusion and recommendation

Research on the determinants of fish exports in ASEAN countries has been carried out by analyzing the influence of several factors on fish exports. The following are the conclusions of each variable studied. The findings revealed that GDP had a significant influence on fish exports. High GDP growth tends to increase people's purchasing power, triggering demand for products, including fish. Thus, strong economic growth can increase the potential for fish trade in ASEAN countries. Currency exchange rates have also been shown to have a considerable influence on fish exports. Fluctuations in currency exchange rates can affect the competitiveness of fish exports in international markets. Therefore, currency exchange rate stability can be a crucial factor in increasing fish exports in ASEAN countries. Production also exerted a major influence on fish exports. Research indicates that increasing fish production can increase the supply of fish exports. Hence, efforts to increase fish production in ASEAN countries can potentially increase fish exports on the international market. However, the population of the export destination country did not have a noteworthy influence on fish exports. Overall, this research provides a better understanding of the factors influencing fish exports in ASEAN countries. The results of this research can be a basis for formulating more effective policies in increasing fish exports and strengthening the contribution of the fisheries sector to economic growth in ASEAN countries.

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