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IDENTIFICATION OF SEVERAL ECONOMIC FACTORS AND THEIR RELATIONSHIP WITH FISH EXPORTS OF INDONESIA

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ABSTRACT

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This study aims to analyze and explain the influence fish production, population, exchange rate, GDP growth on fish export in Indonesia. Furthermore, the study will also explain the conditions and differences in export fish to five countries importing fish from Indonesia. This quantitative study utilizes Multiple non-linear regression which is transformed into Multiple Linear Regression as a statistical tool to estimate the parameters of a variable.

The research results show that population size and the rupiah exchange rate negatively impact marine fish exports in Indonesia, while fish production and economic growth in destination countries have no impact. Furthermore, it was found that marine fish exports significantly differ among the five destination countries.

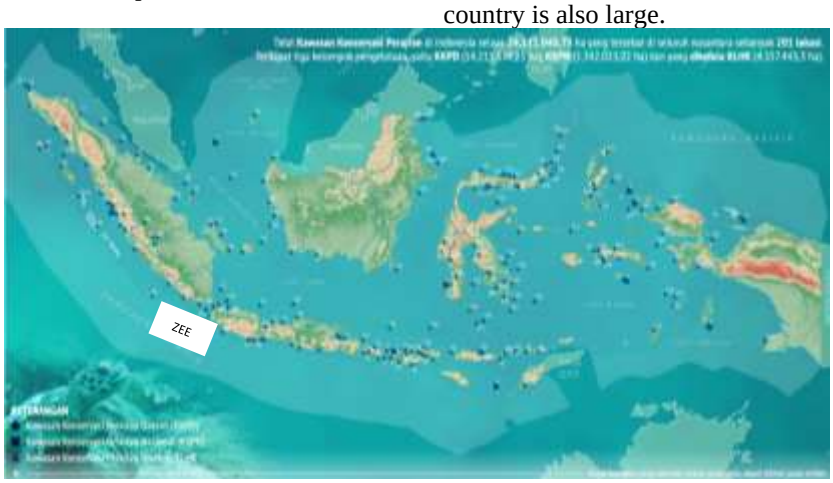
KEY WORDS: ***Fish Production, Population, Exchange Rate, GDP Growth, and Fish Export***

JEL Codes: I20; J30; Q22.

1. INTRODUCTION

Indonesia is an archipelagic country in the world that stretches from Sabang to Merauke. Based on national territorial asset statistics, the area of Indonesian waters reaches 5.9 million km2 including the Exclusive Economic Zone (EEZ), with details of the archipelago area of 2.8 million km2, territorial sea area of 0.4 km2, and claims to the Continental Shelf beyond 200 miles of 3500 km2 west of Aceh (Figure 1). According to Ministry of Maritime Affairs and Fisheries (MMAF, 2025), the EEZ area is approximately 2.7 million km^2 contains many types of fish and other aquatic products that have important economic value.

The marketing of fishery products from the Indonesian EEZ which is directed at the export market has its mainstay products such as tuna and shrimp which are the mainstay export commodities of Indonesian fisheries with a contribution of up to 19.1% of the world supply (MMAF, 2025). Furthermore, in the ASEAN region, Indonesia ranks second as a tuna fish producing country after Thailand. Although not number one, the potential for development is very large because Indonesia's waters are still vast, so the opportunity to increase production is still large and that also means the opportunity to increase exports as an additional source of foreign exchange for the country is also large.



Gamabar 1. Laut Indonesia

Sumber: https://kompaspedia.kompas.id/baca/infografik/peta-tematik/kawasan-konservasi-perairan-di-indonesia

The value of Indonesian fishery exports shows a positive trend, reaching USD 5.07 billion (around IDR 80-90 trillion more) by October 2025, up 5.1% compared to the previous year. The main commodities include shrimp, tuna-skipjack tuna, and squid-cuttlefish-octopus, with the main destinations being the United States, China, India and Japan. The performance of Indonesian marine and fishery product exports shows a positive trend throughout 2025. The Ministry of Maritime Affairs and Fisheries (KKP) recorded that the total export value from January–December 2025 reached USD 6.27 billion or grew 5.2% compared to the previous year. The United States remains the main export destination with a contribution of 31.8% or worth USD 1.99 billion. The next position is occupied by China with USD 1.22 billion (19.5%), ASEAN USD 1.00 billion (16.0%), Japan USD 613.65 million (9.8%), and the European Union USD 451.72 million (7.2%). "The value of exports to the United States increased by 4.7% compared to the previous year, as well as to ASEAN (16.7%), Japan (2.5%), and the European Union (9%)," explained the Acting Director General of Strengthening the Competitiveness of Marine and Fishery Products (Ministry of Maritime Affairs and Fisheries, 2026).

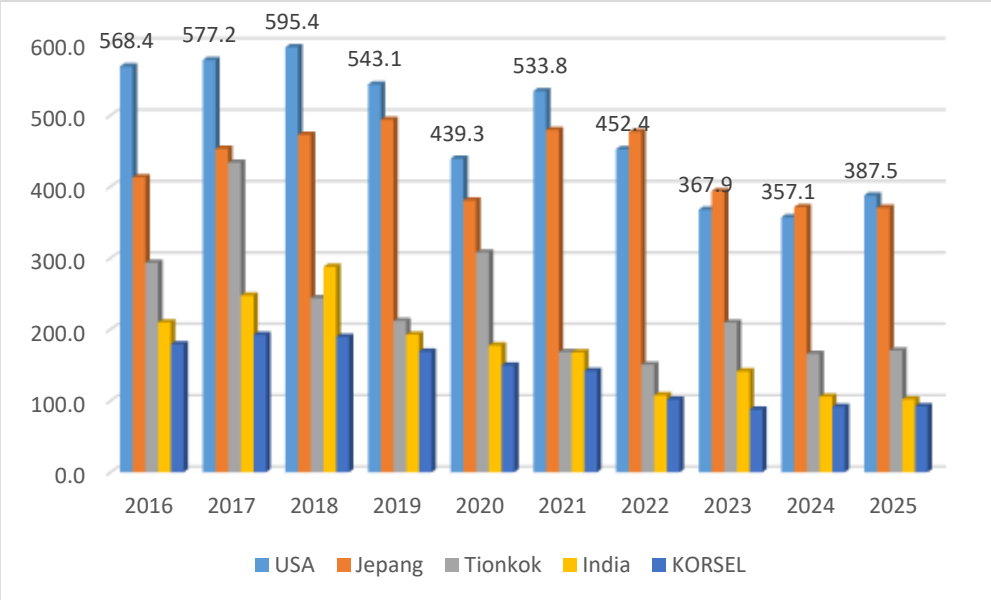


Figure 2. Development of Indonesian Marine Fish Exports

Source: Processed Data

Figure 2 shows the condition or development of fish exports from 2016 to 2018. Marine fish exports increased but after that year decreased or had a negative trend until 2025. The same thing is not too different from Japan's demand for marine fish continued to increase until 2019 and after that year, marine fish imports from Indonesia continued to decline. From the same table, it can also be seen that the five countries importing marine fish from Indonesia have a negative trend, so that the parameters of the variable can be negative. The USA, for example, in 2016 reached a marine fish import value of 568.4 thousand tons in 2016, increasing to 595.4 tons in 2018, or increasing annually by 4.75% or 2.38% annually and decreasing until 2025, or reaching a decrease of 0.54 in the period from 2018 to 2025, or an average decrease of 0.07% annually.

It is truly ironic that Indonesia possesses vast oceans with abundant resources, such as nearly unlimited fish stocks. Unfortunately, these vast oceans, with their primary fish commodity, have not been adequately managed and utilized for their intended purpose. This is evident in the ongoing, unresolved fish theft that occurs in the Natuna Islands. This contrasts sharply with the lives of traditional (small-scale) fishermen who rely on their marine resources, who generally live below the poverty line (Pujiani and Prayogo, 2022; Arief, 1998; Kuncoro, 1997). Furthermore, the causes of poverty among fishermen are limited capital, knowledge, skills, and the use of fishing gear technology, and overfishing, which are often cited as contributing factors to poverty or low welfare improvements in fishing communities (Imron, 2006; 2011).

The development of Indonesian fish and fishery product exports has shown a positive trend in recent years. The Ministry of Maritime Affairs and Fisheries (KKP) indicates that Indonesia is experiencing positive performance. According to data from the Ministry of Maritime Affairs and Fisheries (KKP), as of October 2024, the value of fishery product exports reached USD 4.81 billion, a 4.37% increase compared to the same period the previous year. The government is optimistic that fishery exports will exceed USD 5 billion by the end of 2024. This is strategic, with consistent increases in export value and diversification of destination markets. Many factors determine fish exports, particularly when viewed from the country's ability and appetite to import fish from Indonesia. These include fish production, population, the rupiah exchange rate, and economic growth.

Fish production can have a positive impact on increasing fish exports because a greater supply will also generate high demand, thus encouraging exporters to increase their export activities. Furthermore, the population of the destination country can also determine the quantity and size of fish exports, as this commodity is one of the main and healthy protein needs of the population. Therefore, an increasing population will have an impact on increasing demand for fish from the destination country. Furthermore, the rupiah exchange rate can also determine the level of fish exports, because this exchange rate

is closely related to the rise and fall of prices or costs of raw materials and finished goods for various commodity goods. It is clear that if prices increase, demand will also decrease, which should also occur. Furthermore, economic growth (GDP) is closely related to imports of goods from abroad in a country, because with high incomes also increase consumption according to the Keynesian function, regarding the role of income in consumption. Therefore, a country's population that needs fish to meet domestic consumption needs will increase its imports. In summary and conceptually, the relationship between several economic factors and marine fish exports to five destination countries can be seen in Figure 3.

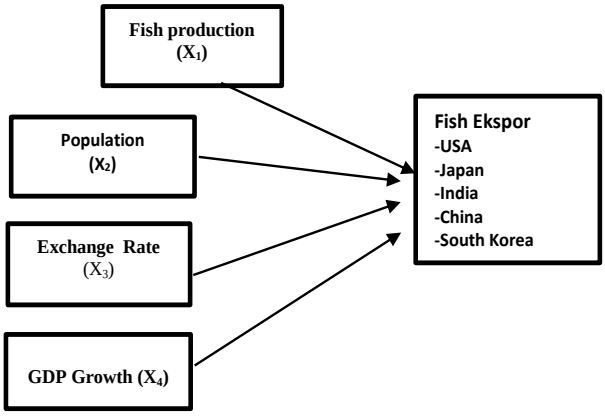


Figure 3. Framework

2. LITERATURE REVIEW

2.1. International Trade Theory

Trade between two or more countries is often called international trade. This inter-country trade can occur due to differences in the prices of goods in various countries caused by differences in quantity, type, quality and how to combine production factors, as well as differences in income and tastes. Therefore, it can be concluded that international trade can occur due to differences in factors that influence supply and demand from various countries (Nopirin, 1999; Nafziger, 2006). It can also be said that the export of commodities from one country to another country represents the difference between domestic supply and domestic demand, or excess supply. This condition arises because of the difference between domestic and international prices. Meanwhile, international prices themselves have a positive relationship with exports, namely that if international prices are higher, exports will also increase (Salvatore, 1997). Furthermore, in principle, there are two factors that cause international trade: factors that influence supply and demand (Krugman, 2000). Supply and demand themselves are interactions between consumers and the capabilities and production possibilities of the local community.

Another theory of international trade is the theory proposed by Adam Smith, namely the absolute theory. In classical theory, there is the concept of absolute advantage, which explains that a country will focus on producing certain types of goods in which the country has an absolute advantage. Countries that have an absolute advantage in exports will specialize in those goods, while other countries that do not have a similar advantage will import those goods. This theory focuses on the efficiency of resource use, including labor, and highlights excellence and competitiveness as the main factors in the production process. In addition to the absolute advantage proposed by Adam Smith, classical theory also presents the concept of comparative advantage, proposed by J.S. Mill and David Ricardo. According to J.S. Mill, countries will gain a comparative advantage by specializing in the production of certain goods for export, while importing other goods to minimize losses. However, if the cost of producing a particular good is lower domestically, then importing that good and producing it domestically will be more expensive. According to David Ricardo, in his book "The Principles of Political Economy and Taxation" in 1817, countries will continue to engage in trade even if they do not have an absolute advantage, or even experience an absolute loss in the production of two types of goods (Ibrahim 2021).

International trade is something that is absolutely carried out by every country, it is a relationship of economic activities from one country to another, which is carried out through a voluntary and mutually beneficial process of exchanging services or goods (Adolf, H. 2004). Currently, there is not a single country that is in autarky or an isolated country without any economic relations with other countries. This is because no country can meet its needs independently. To meet the domestic needs of a country, it can not only be done by producing or producing its own goods/services within its country but can also be done by purchasing goods/services produced by other countries. The existence of an open economic system can encourage a country to carry out international trade cooperation to meet the consumption needs of the population in that country. Both in selling or buying goods/services. International trade allows countries to expand their markets and access goods and services that otherwise may not have been available domestically (Heakal, 2025). These international trade activities are exports and imports. In general, international trade theory can basically be divided into three main groups, namely the Classical Theory from Adam Smith which is also called the Absolute Advantage Theory, the Comparative Advantage Theory, and the Heckscher-Ohlin (H-O) Theory. The Absolute Advantage theory is based more on real quantities/variables, not monetary, so it is often known as the pure theory of international trade. Purely in the sense that this theory focuses its attention on real variables, for example the value of an item is measured by the amount of labor used to produce the item. The more labor used, the higher the value of the goods (Labor Theory of value). Comparative Advantage JS Mill states that a country will

produce and then export goods that have the greatest comparative advantage and import goods that have a comparative disadvantage (goods that can be produced more cheaply and import goods that would cost a lot of money to produce themselves). So this theory states that the value of an item is determined by the amount of labor devoted to producing the item. Comparative Cost from David Ricardo (labor efficiency), menyatakan bahwa a country will gain benefits from international trade if it specializes in production and exports goods where the country can produce relatively more efficiently and imports goods where the country produces relatively less/inefficiently.

A country will trade with other countries because that country has a comparative advantage, namely superiority in technology and superiority in production factors. The basis of comparative advantage is: 1) Endowment factors, namely ownership of production factors in a country. 2) Intensity factor, namely the technology used in the production process, whether labor intensity or capital intensity. Based on the theory above, it can be concluded that international trade exists because of the limited resources owned by each country. Thus, one of the international trade activities is exports and imports to meet the needs of the people in each country and seek profits in increasing the economic growth of each country. This theory can be expanded to include the service sector which produces non-traded domestic services in the fields of transportation, warehousing, wholesale and retail which are needed to market goods to final buyers (Katsioloudes & Hadjidakis, 2007).

2.2. Ekspor

The general definition of export is the transaction of goods and services between the residents of one country and the residents of another country. This includes the export of goods, transportation services, insurance services, communication services, and other services. Exports also include the direct purchase of goods and services within the domestic territory by residents of other countries. Essentially, through foreign trade, a country can increase the production of goods that can no longer be sold domestically but can be sold abroad (Hakim, 2002). With these exports, the country can import foreign goods, not only increasing production levels but also increasing the number of goods consumed by its population. The resulting market expansion will encourage the productive sector to utilize production sectors with higher productivity. One way to achieve this is by importing advanced technology from abroad.

Export development creates economic development not only depending on the rate of export development itself but also on the characteristics and factors that determine its influence on other sectors. Viewed from export activities, the level of economic development as a result of export development will increase if the following conditions apply: a. Higher export levels have a direct impact on employment opportunities, b. Increases in export income received by groups in society have a tendency to import, c. More productive investment is made to finance savings and the export sector, d. The greater the development of exports created by technological developments and not by the expansion of these activities, e. The closer the interconnectedness between sectors with other sectors, f. The more stable the income from sectors that remain domestic (Jhingan, 2021). When viewed from the perspective of domestic market imperfections, the view is not different from the theory of market imperfections pioneered by (Stephen Hymer, 1960; Kindleberger, 1965), as an obstacle to development. Factors such as limited mobility of production factors, very low levels of public education, a shortage of entrepreneurs, and various other factors cause the market system in developing countries to be very imperfect (Todaro, 2020). Therefore, the export of a good is influenced by the policies and market or demand of the destination country, which can be in the form of variables such as GDP per capita or economic growth, exchange rates, and population.

2.2. Sea Fish

Fish are cold-blooded aquatic vertebrates that breathe with gills. Fish are defined as vertebrates that live in water and are systematically placed in the Chordata phylum, characterized by gills that function to absorb dissolved oxygen from the water and fins used for swimming. Fish can be found in almost all types of water in the world with different shapes and characteristics (Adrim, 2010). The general characteristics of the fish group are having a true bony and cartilaginous skeleton, having single or paired fins and having an operculum, a body covered by scales and mucus, and having clear body parts between the head, body, and tail. Fish sizes vary from small to large. Most fish are torpedo-shaped, flat, and some are irregularly shaped (Siagian, 2009).

Fish Nutritional Content: The nutritional composition of fish varies greatly and is influenced by many factors, including species, sex, maturity (age), season, spawning cycle, and geographic location. The protein content of fish is greatly influenced by its water and fat content. However, in general, finfish contain 16–24% protein, while processed fish can contain up to 35%. The proportion of collective protein (collagen) in fish is much lower than in livestock, ranging from 3–5 percent of the total protein. This also contributes to the tenderness of fish meat. Fish, as a source of animal protein, has a relatively high protein content (Ministry of Health of the Republic of Indonesia, 2024).

3. THE METHOD

This type of research is quantitative, taking the type of study of cause and effect that processes numerical data that can be calculated using statistical formulas. The data analysis technique used in this study is Non Linear Regression which is transformed into linear form. Multiple Linear Regression analysis which estimates influence independent variables on dependent variables, SPSS used for estimation in this study. This study uses secondary data, namely data that is already available and collected by certain institutions and it is panel data. The data was taken from the Indonesia Central Statistics Agency (BPS) and the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia by using secondary data from 2016 to 2025 which covers six countries, Indonesia, the United States, China, India, Japan and South Korea.

Based on the conceptual relationship in the framework of thinking, mathematically functional relationships can be written as Based on the conceptual relationship in the framework of thinking, mathematically functional relationships can be written as fish production, population, exchange rate, GDP growth, and Fish Export,

$Y = f(X_1, X_2, X_3, X_4, D)$ ..... (3.1)

Whereas:

X1 = Fish production (total fish catch from natural seawater, both landed at ports and elsewhere, tons)

X2 = Population (number of people in the main export destination countries, people)

X3 = Exchange rate (number of rupiah required to buy one USD, IDR)

X5 = GDP growth (increase in the number of goods and services in export destination countries (America, Japan, India, China, and South Korea, %)

Y = Fish exports (measured by the amount of fish exported from sea catches, tons)

D= Dummy variable (Region: Amerika, Jepang, India, China dan Korea Selatan)

Using non-linear functions so that equation (3.1) can be written:

Using non-linear functions so that equation (3.1) can be written:

$$Y_2 = e^{\beta 0} X_1^{\beta 1} X_2^{\beta 2} e^{X_3^{\beta 3}} e^{X_4^{\beta 4}} e^{\beta D} e^{\mu} \quad \text{.....(3.2)}$$

Transformation of equation (3.2) into linear form is obtained

$$\ln Y = \beta_0 + \beta_1 X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 X_4 + \beta_5 D + \mu_1 \quad \text{.....(3.3)}$$

4. RESULTS AND DISCUSSIONS

4.1. Descriptive Analysis *Production*

Production is the output obtained from a process by sacrificing inputs in the form of production factors. Figure 4 shows the development of output sea fish from year to year.

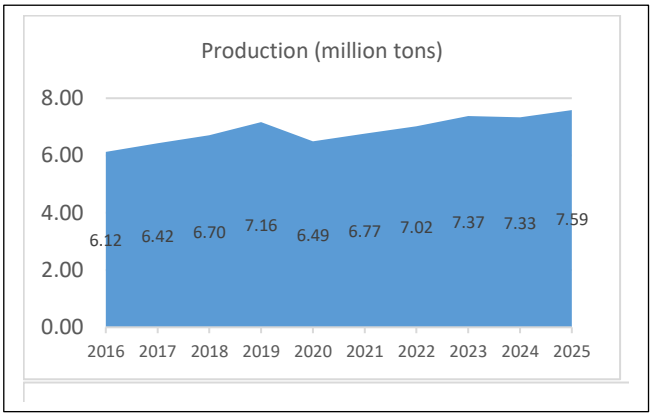


Figure 4. Development of Marine Capture Fisheries Production by Main Commodity

Source: Processed secondary data

The development of primary production (skipjack tuna, mackerel, skipjack, tuna, and shrimp) from 2016 to 2025 from marine capture fisheries has shown a continuous upward trend each year, except in 2020, when the COVID-19 outbreak occurred. In 2016, production reached 6.12 million tons, and by 2025, it had reached 7.59 million tons, representing an average annual increase of 163,333 tons, with an average annual growth rate of 2.67%. Therefore, this growth will clearly boost marine fish exports, as a non-oil and gas commodity that will generate foreign exchange for the country.

Population

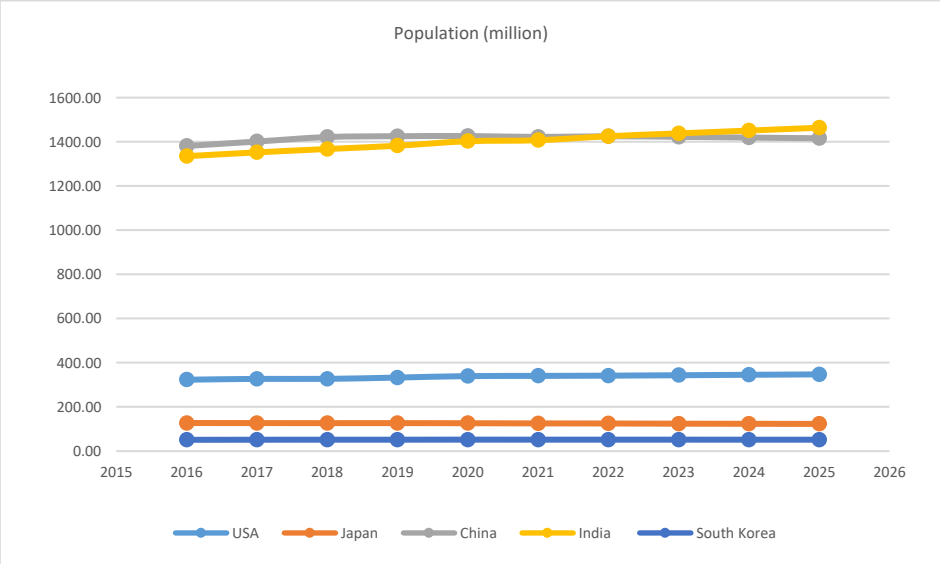
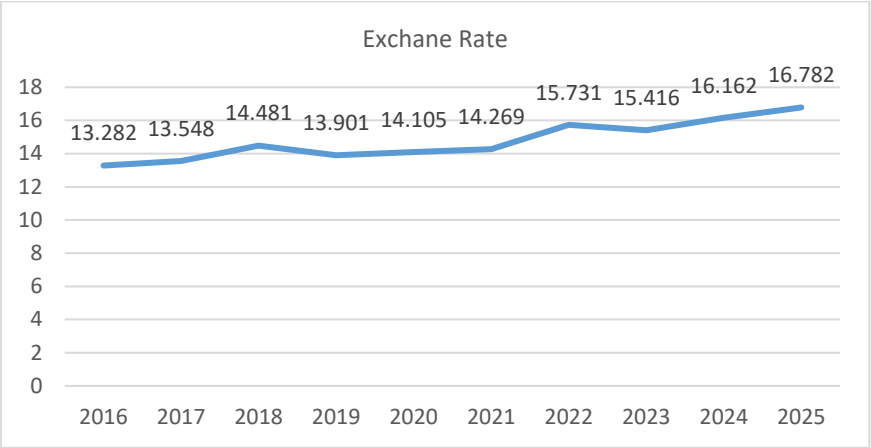


Figure 5. Population Growth of 5 Major Marine Fish Importing Countries from Indonesia

Source: Processed secondary data

It is known that the two most populous countries in the world significantly determine global commodity demand, as nearly all goods are determined by population. In 2016, the population of the United States reached 323.12 million, and by 2025, it will reach 347.28 million, representing a growth rate of 7.47%, or an average of 0.83% (less than 1%) per year. This low growth is typical of developed countries, which generally experience low population growth, with some countries, such as Japan, even experiencing negative growth. Based on the data in Figure 5, Japan's population growth trend is negative. In 2016, the population of Japan reached 126.93 million, and in 2015, it dropped to 123.10 million, representing a growth rate of -0.08% per year. In this same image, it can also be seen that China has long been ranked number 1 in population in the world in terms of quantity, but this has changed direction or position where starting in 2023, India will replace China as the first rank in terms of population in the world.



Gambar 6. Perkembangan Nilai Tukar Rupiah terhadap Dollar USD terhadap

Source: Processed secondary data

Rupiah Exchange Rate

The development of Indonesia Rupiah (IDR) shown a positive trend from year to year, although fluctuations can occur annually, and even monthly. This exchange rate is heavily influenced by the trade balance and export-import balance, inflation, interest rates (the BI rate), and many other factors. Figure 6 shows that the rupiah's value against the US dollar ($1 USD) reached 13,282 rupiah in 2016, and by 2025, it had reached 16,782 rupiah, representing an increase of 26.35%, or an average annual increase of 2.9%. This rate hike could boost Indonesian exports, but it has had significant negative impacts on the economy, particularly for the lower-middle class.

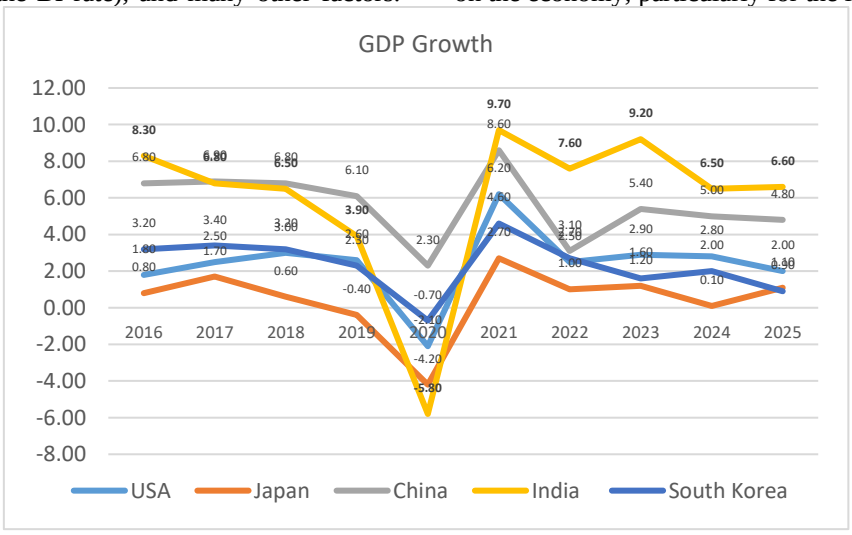


Figure 7. Economic Growth of 5 Major Marine Fish Importing Countries from Indonesia

Source: Processed secondary data

Economic Growth

Figure 7 shows the economic growth or GDP of the five major marine fish importing countries from Indonesia. The same figure shows that in 2016, India had the highest economic growth (8.3%), while Japan only had growth (0.80%), the lowest of the five countries. Furthermore, at the end of the research data period, it was discovered that 2020 was the peak of the COVID-19 outbreak, resulting in negative growth in all five countries, with the exception of China. However, by 2025, India would have the highest growth, while South Korea and Japan had the lowest.

4.2. Analytical Analysis

Analytical analysis here refers to a discussion using statistical analysis.

Model Fit Test

Tabel 1. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.945[a]	.893	.881	.19969
a. Predictors: (Constant), D, X3, X2, X4, X1				

The R^2 value explains that the model used includes Goodness of Fit which indicates the suitability of the model used in the sense of the closeness of the observations to the regression line obtained. Furthermore, Table 1 shows that the regression model built explains that 95% of the variables included in the model can explain the rise and fall of the dependent variable or fish

exports, while the remainder is determined by variables not included in the model.

Tabel 2. ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.709	5	2.942	73.778	.000[a]
	Residual	1.754	44	.040		
	Total	16.464	49			

a. Predictors: (Constant), D, X3, X2, X4, X1

b. Dependent Variable: Y

Table 2 results of the F test show that the testing of independent variables together against the dependent variable was carried out using the F test, obtaining statistical calculation results showing a calculated F value = 73.78 with a significance of 0.000 <0.05, so it can be concluded that the significance value below 0.05 indicates that together the variables of the amount of fish production, population, exchange rate and economic growth (GDP) have a significant influence on fish exports together. Thus, partial analysis can be continued, where the t test can be seen in Table 3.

Tabel 3. Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	37.349	6.046		6.178	.000		
	X1	-.858	.920	-.093	-.932	.356	.245	4.085
	X2	-.075	.028	-.170	-2.706	.010	.610	1.639
	X3	-2.073	.760	-.271	-2.727	.009	.245	4.077
	X4	.003	.012	.017	.270	.789	.585	1.710
	D	-.361	.022	-.891	-16.542	.000	.835	1.197

a. Dependent Variable: Y

Based on Table 3, it can be confirmed that this regression analysis does not have multi correlation, resulting in the influence of the independent variable. This causes the regression coefficient to be unstable, difficult to interpret, and the standard error increases, making it difficult to determine the influence of each variable on the dependent variable. Table 3 shows that population and exchange rate variables have a negative effect on fish exports. This negative effect of the exchange rate is consistent with research conducted (Ilmas et al., 2022). Therefore, the negative relationship results from the decline in imports from destination countries, as stated in the research background, while the dollar exchange rate continues to increase from year to year. Meanwhile, the dummy variable also has a positive effect, indicating a difference in the average marine fish imports from the five countries from Indonesia. Meanwhile, production and economic growth do not have a significant effect on exports at the $\alpha = 0.05$ confidence level. A 1% increase in the population of the destination country causes a 0.08% decrease in exports, while a 1% increase in the exchange rate causes exports to also decrease by 2.07%.

Fish production does not significantly impact fish exports, due to the diversification and distribution of fish exports to various countries, not limited to just five. Marine fish production, which generally includes: skipjack tuna, mackerel, tuna, shrimp, and squid, continues to increase, as previously explained. However, demand is declining due to population declines, such as those in Japan, which are 0.44% to 0.5% per year. Data as of April 2025 showed a total decline of 898,000 people (the largest since 1950), bringing the total population to 120.3 million. This downward trend has persisted for 14 consecutive years due to low birth rates (World Bank, 2025).

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

Based on the previous discussion and statistical analysis, the following conclusions are drawn:

Population and the rupiah exchange rate negatively impact Indonesian marine fish exports, while marine fish production and the economic growth of destination countries have no effect. Furthermore, marine fish exports differ significantly among the five destination countries.

5.2. Recommendation

The suggestions to be put forward based on the discussion and conclusions that have been stated, among others

Marine fish production continues to increase, and demand from destination countries is trending negatively. Therefore, the government should continually seek new export markets. The government continues to promote and diversify products, while maintaining supplies for export. The rupiah exchange rate negatively impacts exports; however, the government must strive to maintain and even lower the rupiah exchange rate so that exports from fishermen and the lower-middle class in general can benefit from the prices and sales of their catches.

6. RESEARCH SHORTCOMINGS

This study has shortcomings in its analytical tools. Amos was originally planned, but due to data constraints due to lack of data that can be collected, SPSS was used. Therefore, Statistically, each destination country is not described

individually and only 5 nation included. Furthermore, this study only discusses sea fish in general, there are insufficient variables included in the model to fully discuss Indonesian sea fish exports.

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