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ANALYSIS OF DEMAND AND COMPETITION FOR INDONESIAN FROZEN TILAPIA FILLET WITH MAJOR COMPETITORS IN THE INTERNATIONAL MARKET

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ABSTRACT

Frozen tilapia fillets are the only farmed fish among Indonesia's leading fishery export commodities. Fierce competition requires Indonesia to maintain its position. This study aims to analyze the demand for and competition with major competitor countries in the international market for Indonesian frozen tilapia fillets. This study employs the Almost Ideal Demand System (AIDS) and estimates it using the Seemingly Unrelated Regression (SUR) method. The data source is secondary data obtained from ITC Trade Map with HS code 030461 (Frozen fillets of tilapia "Oreochromis spp."). The analysis is based on panel data with monthly time series from 2014 to 2024. Meanwhile, cross-sectional data uses China, Taiwan, the Netherlands, and the USA as Indonesia's main competitors. The findings indicate that demand for Indonesian frozen tilapia fillets is price-inelastic, meaning it is relatively unresponsive to price changes. Indonesian frozen tilapia fillets are classified as inferior goods with an elasticity value of -0.478. This implies that a rise in consumer income will actually reduce demand. The cross-price elasticity indicates that Indonesia tends to compete with China, Taiwan, the Netherlands, and the USA. This is because the relationship between Indonesian frozen tilapia fillet and competing countries is one of substitution. The findings of this study reveal that Indonesia must focus on strategies to improve product quality and production efficiency in order to strengthen its position in the global market. Exporters need to increase the value of their products through diversification, quality certification, and compliance with international standards in order to survive and compete with rival countries.

Keywords: AIDS model; export; frozen fillets of tilapia; international trade.

INTRODUCTION

Indonesia is a maritime country with 65% of its total area covered by water (Gerungan, 2016). Favorable geographical conditions make Indonesia a country with abundant fishery resources. Indonesia's fisheries production in 2024 reached 11.8 million tons. The high production of the fisheries sector has led to a surplus in Indonesia's trade balance of USD 2.49 billion (Ministry of Maritime Affairs and Fisheries, 2025). This ranks Indonesia second, after China, as the world's largest fisheries producer (Anam, 2021). Sources of fish acquisition are divided into three: maritime capture fisheries, inland public waters fisheries, and capture fisheries. According to the Central Statistics Agency (2022), maritime capture fisheries production reached 7.03 million tons, inland public fisheries reached 462.97 thousand tons, and capture fisheries reached 7.49 million tons. This shows that most of the domestic protein needs and importing countries of Indonesian fishery products are dominated by capture fisheries.

However, the FAO (Food and Agriculture Organization) predicts that by 2050, the world population will grow by more than 30%. An increase certainly follows, with global protein demand rising by up to 70%. Meanwhile, the FAO states that protein needs are difficult to meet if they depend solely on capture fisheries (Ministry of Maritime Affairs and Fisheries, 2024a). This condition is undoubtedly an excellent opportunity for aquaculture to meet the growing world population and

increasing protein needs. The Ministry of Maritime Affairs and Fisheries, together with the government, develops the potential of sustainable aquaculture, especially focusing on export-leading commodities such as shrimp, seaweed, tilapia, lobster, and crab. According to data from the Ministry of Maritime Affairs and Fisheries (2025), tilapia is the only aquaculture commodity among Indonesia's top ten leading export commodities. Tilapia is ranked 9th, with an export volume of 9,417 tons in 2024.

Tilapia is a freshwater fish genus, Oreochromis, consisting of two species: tilapia and tilapia. In addition to abundant resources, tilapia is a resilient fish that can survive in environments with low water quality (Ministry of Maritime Affairs and Fisheries, 2023). Due to these advantages, the Ministry of Maritime Affairs and Fisheries has designated tilapia fish as one of the primary commodities developed through integrated aquaculture to meet domestic and global demand. Indonesia is the world's second-largest tilapia producer after China. This is evidenced by Indonesia's tilapia production, which continues to grow. The average annual growth rate of Indonesian tilapia production for the 2018-2022 period was 3.56%. Although production decreased by 14.36% in 2020, it increased again in 2022 to reach 1.42 million tons.

Tilapia is available in several product forms, including whole, fresh or chilled; whole, frozen; fresh or chilled fillets; and frozen fillets. The type of tilapia fish that dominates exports in the global market is frozen fillets. According to the Ministry of Maritime Affairs and Fisheries (2023), frozen tilapia fillets account for 59.7% of global tilapia imports. This is followed by frozen whole tilapia at 22.2%, while the remaining tilapia fillets and fresh or chilled whole tilapia account for 13.6% and 4.6% respectively. Based on Trade Map data (2025), Indonesia holds an important position as a major exporter of frozen tilapia fillets. Indonesia has held 21.77% of the world's frozen tilapia fillet market share over the last 10 years. The export destinations for Indonesia's frozen tilapia fillets include the USA, Canada, the European Union, and other countries. According to data from the ITC Trade Map, the USA is the leading destination, accounting for 65.53% of Indonesia's frozen tilapia fillet exports to the global market, valued at US$60.45 million.

Although Indonesia's tilapia production has experienced positive growth, it still lags behind China in global market dominance. This is reflected in Indonesia's market share, which still falls short of capturing even half of the global frozen tilapia fillet market. However, tilapia production in China has slowed down due to the domino effect of low prices and high feed costs. The slowdown in China's tilapia production could provide an opportunity for Indonesia to become the world's first producer. On the other hand, more and more countries are entering the global frozen tilapia fillet market, intensifying competition. This situation presents a challenge for Indonesia to sustain its current standing and, if possible, enhance it further.

So far, many studies have examined competition in fishery commodity exports, including García-del-Hoyo et al. (2017) on canned tuna products in Spain, Nankwenya et al. (2017) on fishery products in Malawi, and Hsu et al. (2023) on imported fishery products in Japan. Similar research was also conducted in Indonesia by Kristiani et al. (2023) on processed tuna and Nurzakiah et al. (2025) on frozen eel. Meanwhile, research on frozen tilapia fillets remains limited to general export competitiveness, as in Utami's study. The study analyzed only the competitiveness of tilapia using RCA, without discussing the demand and competition for frozen tilapia fillets in Indonesia and other exporting countries. On the other hand, research by Ningsih et al. (2016) focused on analyzing the competitiveness of tilapia fish farming in pond businesses.

Previous studies have focused solely on measuring tilapia's competitiveness. This research is the first to apply the AIDS model to examine both demand and market competition for Indonesia's frozen tilapia fillets. The updated AIDS model was applied by Kristiani et al. (2023) to examine the demand for processed tuna products in the Japanese market and by Nurzakiah et al. (2025) to examine the demand for frozen eel in the international market. Understanding the demand conditions in the international market is important to determine the level of competition and effective marketing strategies. Therefore, this study aims to analyze the demand dynamics and competitive position of Indonesian frozen tilapia fillet exports vis-à-vis major competitors in the international market.

MATERIALS AND METHODS

The research was conducted from April to May 2025. This study used secondary data sourced from ITC Trade Map with HS 030461 (Frozen fillets of tilapia "Oreochromis spp."). The study employs panel data, which merges both time-series observations and cross-sectional information. The time series data comprises monthly observations from January 2014 to December 2024, yielding a total of 132 research observations. Meanwhile, the cross-sectional data includes comparison

countries such as China, Taiwan, the USA, and the Netherlands, which are major exporters and competitors of Indonesia over the last 10 years. The variables used in the AIDS model are as follows:

Table 1. Research variables

Variables	Data Sources
Export value of frozen tilapia fillet from Indonesia, China, Taiwan, the Netherlands, and the USA (US$)	ITC Trade Map
Volume of frozen tilapia fillet exports from Indonesia, China, Taiwan, the Netherlands, and the USA (kg)	ITC Trade Map
Value of global frozen tilapia fillet imports (US$)	ITC Trade Map
Market share of frozen tilapia fillet from Indonesia, China, Taiwan, the Netherlands, and the USA	ITC Trade Map
Price of frozen tilapia fillet from Indonesia, China, Taiwan, the Netherlands, and the USA (US$/kg)	ITC Trade Map

This study employs the Almost Ideal Demand System (AIDS) model for its analysis. The AIDS model was introduced by Deaton & Muellbauer (1980) to analyze consumer demand. This model estimates group demand parameters using group expenditure, accounting for demand elasticity (Basarir, 2013). The AIDS model will be analyzed with the SUR (Seemingly Unrelated Regression) method (Green & Alston, 1990). This method was chosen because it can account for the possible relationship between error terms across demand equations. The use of the SUR method can produce more efficient estimates than OLS because it utilizes information from the entire system simultaneously (Barten, 1969). The AIDS model can also identify demand and competition for frozen tilapia fillets across exporting countries using expenditure, demand, and cross-price elasticities. The AIDS model used refers to Deaton and Muellbauer (1980) with the following equation:

$$W_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log P_j + \beta_i \ln \frac{x}{p^*} \quad (1)$$

Where: W = Export share of frozen tilapia fillet of exporting country i in the world (Indonesia, China, Taiwan, Netherlands, and USA), P = The price of the product in the exporting country of origin, X = The overall value of imported products, p* = Geometric price index stone= Σwi.pi

Many studies using the AIDS model have been conducted to analyze how Indonesia competes with exporting countries for superior commodities such as plantation and fishery products. Studies on AIDS in plantation commodities have been conducted by Nurzakiah et al. (2024) on TSNR-type rubber products, Adetya et al. (2025) on coffee bean products, Dewanti et al. (2020) on Crude Coconut Oil products, Aulia et al. (2019) on Refined Palm Oil (RPO) products, and Annisa et al. (2021) on cinnamon powder products. However, studies on AIDS in fishery commodities in Indonesia are still limited to the research by Kristiani et al. (2023) on processed tuna products and by Nurzakiah (2025) on frozen eel products.

Pre-treatments such as unit root tests and stationarity tests are not required for panel-data AIDS models. This is because economic variables are assumed to be deterministic over time (Deaton & Muellbauer, 1980; Banks et al., 1997; Green & Alston, 1990). However, the AIDS model used in the study must also fulfill three conditions to ensure the theoretical consistency of the equations (Moschini, 1998). The three conditions are consumer demand theory, so that the estimation results are consistent with economic theory (Deaton & Muellbauer, 1980; Moschini, 1998). These conditions can be automatically fulfilled in the AIDS model, as follows:

Adding up states that all expenditure allocated to all commodities must equal one.

$$\sum_{j=1}^{n} \propto_i = 1, \sum_{j=1}^{n} \gamma_{ij} = 0, \sum_{j=1}^{n} \beta_i = 0 \quad (2)$$

Homogeneity implies that when price and income double simultaneously, the amount demanded will not change.

$$\sum_{j=1}^{n} \gamma_{ij} = 0 \quad (3)$$

Symmetry describes a substitution effect between commodities that shows consistency in consumer preferences.

$$\gamma_{ij} = \gamma_{ji} \quad (4)$$

Next, to determine the demand conditions and level of competition among exporting countries, calculations are made for expenditure elasticity, demand elasticity, and cross-price elasticity. The equations for these three types of elasticity are as follows:

Expenditure Elasticity

Expenditure elasticity measures how changes in consumer spending affect the quantity demanded of a product (Harianto et al., 2022). The expenditure elasticity is calculated from the estimated β_i parameter from the AIDS model regression and the average market share of frozen tilapia fillet in each exporting country. If the elasticity value is greater than zero (>0), then frozen tilapia fillets are classified as everyday goods. Conversely, if the elasticity is negative (<0), then frozen tilapia fillets are classified as inferior goods.

$$\eta_i = 1 + \frac{\beta_i}{w_i} \quad (5)$$

Own Price Elasticity

Demand elasticity is used to determine the extent of the response in demand for frozen tilapia fillet to a price increase (Harianto et al., 2022). Demand elasticity is also called price elasticity because it shows the response of demand to changes in the price of a product within the country. The value of demand elasticity is generally negative, as per demand theory. When a product's price rises, its demand declines. If the elasticity value is >1, then demand is elastic. An elasticity value of one indicates that demand is unitary. Meanwhile, if the elasticity value is <1, then demand is inelastic.

$$e_{ij} = -\delta_{ij} + \frac{\gamma_{ij} - \beta_i w_j}{w_i} \quad (6)$$

Cross Price Elasticity

Cross-price elasticity measures how a country's demand for frozen tilapia fillets responds to price increases in other countries (Harianto et al., 2022). This implies that when the price of frozen tilapia fillet rises in one exporting country, the demand for the same product from other exporters may either increase or decline. An elasticity value >0 indicates that products from different exporting countries serve as substitutes for one another. In contrast, an elasticity value < 0 indicates that these products act as complements in the market.

$$e^*_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} + w_j \quad (7)$$

Where: γ_{ij} = The price coefficient of frozen tilapia fillets in country *j,* β_i = The coefficient representing the total export value of frozen tilapia fillets in country *j,* w_i = Export share of frozen tilapia fillet from country I, w_j = Export share of frozen tilapia fillet from country j, δ = kronecker delta is δ=1 for i=j and δ=0 if i≠j

RESULTS AND DISCUSSION

Overview of Indonesian Frozen Tilapia Fillet Exports

Indonesian fishery products are in demand in the international market. The development of Indonesia's leading fishery commodities exports is shown in Figure 1. Exports of fishery commodities during the 2023-2024 period were dominated by capture fisheries, such as shrimp, seaweed, tuna (tongkol/skipjack), and squid (cuttlefish/octopus), which accounted for the highest volume. The data show that tilapia is the only farmed fish among the top ten leading Indonesian fishery exports. Although tilapia export volumes are smaller than those of other commodities, it ranks ninth among commodities. However, tilapia exports still have significant potential for further development as a farmed commodity, which could increase the contribution of the aquaculture sector to fisheries exports.

The trend in export values of frozen tilapia fillets among the world's top 10 exporting countries is shown in Figure 2. China is the largest exporter, with export values that continued to increase during the 2020-2024 period, despite a decline in 2023. Indonesia ranks second in terms of consistent annual export growth. Meanwhile, other exporting countries, such as Taiwan, Vietnam, Honduras,

Malaysia, Germany, the Netherlands, and Peru, show relatively low export values. This data indicates the dominance of China and Indonesia in the frozen tilapia fillet trade.

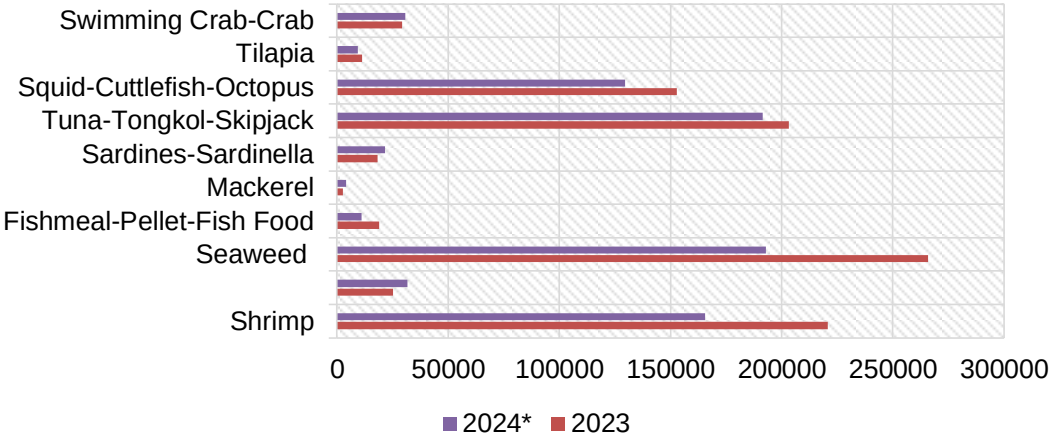

Figure 1. Trends in the export volumes of Indonesia's fishery products (tons)
Source: Ministry of Maritime Affairs and Fisheries (2025)

The destination countries for Indonesia's frozen tilapia fillet exports are shown in Figure 3. The United States is the largest destination market, with a 65.53% share, indicating that most of Indonesia's tilapia is absorbed by the USA market. Other markets include Canada (11.94%), the European Union (7.52%), and other countries (15.01%), all of which contribute to demand for Indonesian frozen tilapia fillets. The dominance of the USA as a destination country not only reflects high consumer demand but also its role as a re-exporter of frozen tilapia fillets to importing countries.

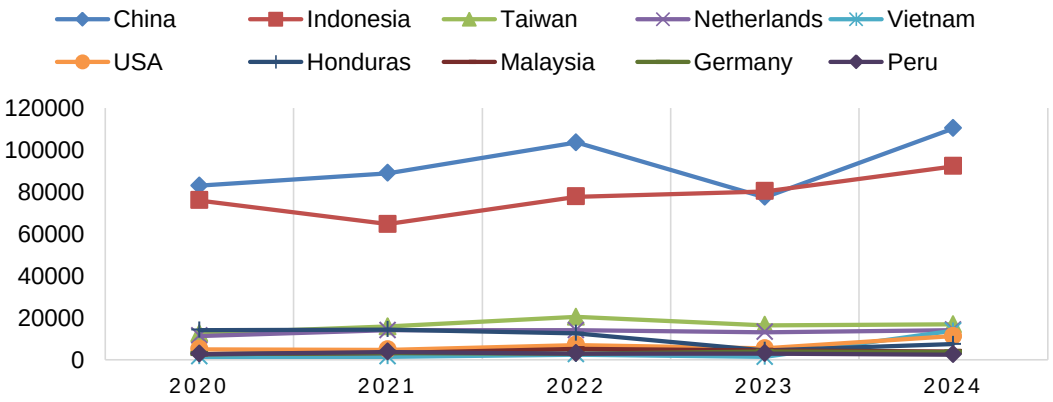

Figure 2. Largest exporter of frozen tilapia fillets in the international market (US$)
Source: ITC Trade Map (2025)

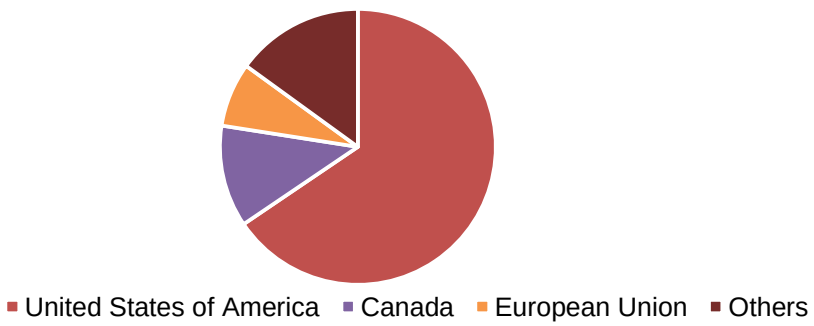

Figure 3. Destination Markets for Indonesia's Frozen Tilapia Fillet Exports in the World in 2024
Source: ITC Trade Map (2025)

Market Share of Frozen Tilapia Fillet Exporting Countries

The increasing demand for protein has driven the export of frozen tilapia fillets in the global market. This is an opportunity for tilapia-producing countries to expand their market share in the global market. Indonesia's increasing tilapia production has positioned it among the world's major producers. Its contribution to global frozen tilapia fillet exports is demonstrated by its share of the international market.

Table 2. Market shares of countries exporting frozen tilapia fillets

Country	Average Market Share (%)
Indonesia	21.77
China	57.89
Taiwan	5.21
Netherlands	3.58
USA	1.82
Rest of the World	9.74

Source: Data processed from ITC Trade Map (2025)

As shown in Table 2, Indonesia accounts for 21.77% of the global market share for frozen tilapia fillets over the last decade. China is ranked as the world's first exporter of frozen tilapia fillet. This is demonstrated by China's dominance of nearly half of the global frozen tilapia fillet market. Taiwan, the Netherlands, and the USA account for 5.21%, 3.58%, and 1.82%, respectively. At the same time, the rest of the world's frozen tilapia fillet exports amounted to 9.74%. The market share percentage can indicate Indonesia's main competitors in frozen tilapia fillet products. In addition, market share is one of the components used to estimate the demand function and measure elasticity in the AIDS model.

Coefficients and P-Values of Export Demand for Frozen Tilapia Fillet in Exporting Countries

After running the estimation in STATA, the resulting analysis must satisfy three conditions to ensure that the equation aligns with demand theory. The first condition, adding up, has been fulfilled because the expenditures represented by the market percentage values for exporting countries (Indonesia, China, Taiwan, the Netherlands, and the USA) and the rest of the world are equal to 1. The second condition, homogeneity, is satisfied when the coefficient of each equation is zero. This shows that demand cannot change even though prices and income change. The third condition, symmetry, is satisfied because there is a substitution effect. The estimation results show that as the price of Indonesian frozen tilapia fillets increases, demand for Chinese frozen tilapia fillets also increases. If the price of China's frozen tilapia fillets increases, demand for Indonesia's frozen tilapia fillets also increases. This condition shows the consistency of global consumer preferences for frozen tilapia fillet.

Table 3. Values coefficient and p-value demand export frozen tilapia fillet

Country	R-square	P-value
Indonesia	0.869	0.000
China	0.945	0.000
Taiwan	0.595	0.000
Netherlands	0.774	0.000
USA	0.494	0.000

Source: Data processed from ITC Trade Map (2025)

Table 3 shows the R-Square values for the exporting countries of frozen tilapia fillets. This indicates that the independent variables can explain 94.5% of the variation in frozen tilapia fillet export market shares for China, 86.9% for Indonesia, 59.5% for Taiwan, 77.4% for the Netherlands, and 49.4% for the USA. China and Indonesia have the highest R-Square values, indicating that the model explains variation in export demand for frozen tilapia fillets well in both countries. The p-values for the five frozen tilapia fillet-exporting countries are <0.05 and even <0.01. This value indicates that the variable is significant at the 5% and 1% levels. According to Yafi et al. (2024), if the significance at the 5% and 1% levels indicates that the equation for five countries exporting frozen tilapia fillets has a significant effect.

Analysis of Demand and Competition for Indonesian Frozen Tilapia Fillet with Exporting Countries

Based on Table 4, the results from the demand elasticity formula indicate that the elasticities of the five exporting countries are negative. A negative value shows that the results align with demand theory. When prices rise, demand for frozen tilapia fillets decreases (Pinto et al., 2022). The elasticity of demand for frozen tilapia fillets in Indonesia, Taiwan, the Netherlands, and the USA is <1, indicating inelasticity and a lack of responsiveness to price changes. The results of this study are consistent with those of Kristiani et al. (2023), who found that Indonesian processed tuna products are price-inelastic in the Japanese market. However, this is inconsistent with the findings of Surbakti et al. (2024) and Nurzakiah et al. (2024), which indicate that Indonesian Technically Specified Natural Rubber and banana are price-sensitive (i.e., elastic).

Table 4. Demand elasticity of frozen tilapia fillet exporting countries

Country	Demand Elasticity
Indonesia	-0.649
China	-1.643
Taiwan	-0.930
Netherlands	-0.925
USA	-0.981

Source: Data processed from ITC Trade Map (2025)

Indonesia has the lowest demand elasticity value of -0.649. A 1% price increase is estimated to reduce demand for Indonesia's frozen tilapia fillets by 0.649%. Inelastic demand will benefit Indonesia because producers can play with prices. The demand for frozen tilapia fillets in Indonesia decreases less than that of other exporters when prices rise. This is supported by Carlucci et al. (2015), who found that consumers do not react strongly to price changes for goods with low elasticity. Although inelastic, producers need to maintain the quality and continuity of the supply of frozen tilapia fillets. Some consumers are sometimes more sensitive to quality and availability than price (Kristiani et al., 2023).

Demand for frozen tilapia fillets is inelastic because Indonesia was the second-largest supplier after China from 2014 to 2024. In 2023, Indonesia's frozen tilapia fillet exports exceeded China's, which experienced a significant decline (ITC Trade Map, 2025). This was because tilapia production in China declined due to low prices and high feed costs (Ministry of Maritime Affairs and Fisheries, 2023). This means that if China is unable to meet market demand, consumers will switch to frozen tilapia fillets from Indonesia. Export markets with long-standing contracts with exporters are bound by product supply and specifications, limiting their ability to switch suppliers (Goldberg & Knetter, 1997).

On the other hand, frozen tilapia fillets from Indonesia have an advantage over those from other exporting countries because they are ecolabel-certified (Ministry of Maritime Affairs and Fisheries, 2024b). This certification means that frozen tilapia fillets from Indonesia have the highest prices in the United States market, where it is the leading importer, compared to products from China, Taiwan, and Honduras. During the 2021-2022 period, there were no rejections of frozen tilapia fillets from Indonesia in the US market. Meanwhile, during the same period, 17 shipments of frozen tilapia fillets from China were rejected due to issues related to veterinary drugs, labeling, nitrofurans, and pesticide residues (Ministry of Maritime Affairs and Fisheries, 2024b).

Meanwhile, the elasticities of demand in Taiwan, the Netherlands, and the USA are -0.930, -0.925, and -0.981, respectively. A 1% price increase would reduce demand for frozen tilapia fillets from these three countries by 0.930%, 0.925%, and 0.981%, respectively. Although considered inelastic, the demand for frozen tilapia fillets from Taiwan, the Netherlands, and the USA is quite sensitive, as evidenced by elasticity values close to 1. Excessively high price increases can significantly reduce demand from these three countries (Mankiw, 2018).

China has an elasticity value >1, which means it is elastic. When the price of frozen tilapia fillets in China increases by 1%, demand declines by 1.643%. Elastic demand is highly price-sensitive (Surbakti et al., 2024). This condition puts China at a disadvantage. Research by Aulia et al. (2019) states that high demand elasticity indicates that the position of commodities in that country is less stable than in other countries. Although China dominates global tilapia production, its output declined in 2023 (Ministry of Maritime Affairs and Fisheries, 2023). This is because the low price of Chinese tilapia in the domestic market, coupled with high feed prices, has led farmers to reduce seed stocking by 30%. On the other hand, frozen tilapia fillets from China have been rejected in the US market because they do not have eco-label certification (Ministry of Maritime Affairs and Fisheries, 2024b).

The results of the AIDS analysis, processed using the expenditure elasticity formula, are shown in Table 5. The expenditure elasticities of Indonesia, Taiwan, the Netherlands, and the USA are negative (E<0). This means that frozen tilapia fillets from these four countries are classified as inferior goods (Harianto et al., 2022). If global consumer income increases, demand for frozen tilapia fillets in Indonesia, Taiwan, the Netherlands, and the USA will decrease. Indonesia's expenditure elasticity is -0.477, meaning that when consumer spending increases by 1%, demand decreases by 0.477%. Taiwan's expenditure elasticity is greater than that of Indonesia, the Netherlands, and the USA at -0.929. If consumer spending increases by 1%, demand for frozen tilapia fillets in Taiwan will decrease by 0.929%.

Table 5. Elasticity expenditure country exporter of frozen tilapia fillet

Country	Expenditure Elasticity
Indonesia	-0.477
China	2.138
Taiwan	-0.929
Netherlands	-0.451
USA	-0.262

Source: Data processed from ITC Trade Map (2025)

Meanwhile, the expenditure elasticity in the Netherlands and the USA is lower than in Indonesia. The expenditure elasticity in the Netherlands is -0.451%, while that in the USA is -0.262%. If global consumer spending increases by 1%, demand for frozen tilapia fillets in the Netherlands and the USA will decrease by 0.451% and 0.262%, respectively. This condition is different from China, which has a positive expenditure elasticity (E>0). This value indicates that frozen tilapia fillets in China are classified as everyday goods (Harianto et al., 2022). An increase in consumer spending will drive 2.138% growth in China's demand for frozen tilapia fillets. This study is not in line with Adetya et al. (2025), which states that Indonesian coffee beans in the international market are classified as inferior goods. However, this study is consistent with the findings of Surbakti et al. (2024), Aulia et al. (2019), Nurzakiah et al. (2024), and Kristiani et al. (2023), which indicate that several Indonesian agricultural commodities are classified as everyday goods.

Rosario's (2022) research states that positive expenditure elasticity reflects high quality and attractiveness. In line with the research by Tomek & Robinson (1990), high-quality commodities generally exhibit greater expenditure elasticities. This is evidenced by China's ability to lead the global frozen tilapia fillet market for years with a market share of more than 50%. As the world's leading tilapia producer, China has boosted production by implementing industrialization. The program consists of the use of superior seeds, mass production that efficiently utilizes resources, and the processing of aquaculture products (Ministry of Maritime Affairs and Fisheries, 2023). China focuses on processing through two approaches: food safety and environmental protection. However, during the 2021-2022 period, Chinese frozen tilapia fillets were rejected in the USA market due to not meeting established quality standards.

The findings of the AIDS model analysis, calculated using cross-price elasticity, are presented in Table 6. Based on calculations, the cross-price elasticities of Indonesia with China, Taiwan, the Netherlands, and the USA are all positive (>0). This means that Indonesia is substituting for China, Taiwan, the Netherlands, and the USA in the international market. The cross-price elasticity of Indonesian frozen tilapia fillets with respect to China is 0.462. A 1% increase in the price of frozen tilapia fillets in China will lead to a 0.462% rise in demand for Indonesian frozen tilapia fillets. Meanwhile, the cross-price elasticities for Indonesia with Taiwan, the Netherlands, and the USA are smaller than those with China. The cross-price elasticities of frozen tilapia fillets from Indonesia with Taiwan, the Netherlands, and the USA are 0.044, 0.013, and 0.053, respectively. If the price of frozen tilapia fillets in those three countries rises by 1%, the demand for Indonesia's frozen tilapia fillets will increase by 0.044%, 0.013%, and 0.053%, respectively.

Table 6. Elasticity price cross country exporter of frozen tilapia fillet

Country	Indonesia	China	Taiwan	Netherlands	USA
Indonesia	-	0.462	0.044	0.013	0.053
China	0.174	-	0.024	0.028	0.048
Taiwan	0.266	0.393	-	0.015	0.051
Netherlands	0.151	0.880	0.029	-	0.178
USA	0.223	0.535	0.035	0.062	-

Source: Data processed from ITC Trade Map (2025)

The results also show that frozen tilapia fillets from the five exporting countries are either substitutes or competitors. If there is a price increase in one exporting country, demand will increase in the other four. A price increase in one country benefits the other four countries. Substitutable products indicate a competitive market because consumers can choose from similar products from various exporting countries (Krugman et al., 2018). Consumers can switch to other exporters' products, especially price-oriented ones. The findings of this study are consistent with those reported by Kristiani et al. (2023) and Nurzakiah et al. (2024) that Indonesia tends to compete with other exporting countries. Not only that, even palm oil and coffee beans from Indonesia face intense competition (substitution) from other competitors in both the European Union Market and the international Market (Firohmatillah & Simanjuntak, 2022; Hasibuan & Putra, 2023).

Elasticity calculations show that Indonesia's position in the international frozen tilapia fillet trade is quite strong. However, it still faces competition from other exporters such as China, Taiwan, the Netherlands, and the USA. Inelastic demand shows that global consumers are not sensitive to changes in the price of Indonesian frozen tilapia fillets. This provides exporters with an opportunity to optimize selling prices without significantly reducing demand. However, this condition also requires exporters to maintain quality, supply continuity, and compliance with international standards. Although demand for Indonesian frozen tilapia fillets is inelastic, competitive pricing strategies and production efficiency need to be considered. The government can encourage innovation in feed efficiency and aquaculture technology, such as the Recirculating Aquaculture System (RAS), to reduce production costs and maintain price competitiveness.

Indonesian frozen tilapia fillets are classified as inferior goods, so the government and businesses need to strengthen product quality standards. Food safety and environmental protection certification, as well as compliance with international regulations, are essential, especially for importers from developed countries. The government and businesses need to expand the implementation of certification to maintain market access in the United States and the European Union. The research also finds that Indonesian frozen tilapia fillets are substitutable with those of other exporters, so a product diversification strategy is essential. Exporters can add value to their products, for example, by producing fillets with distinctive seasonings that suit consumer preferences. This aims to reduce dependence on a single market segment and avoid the risk of direct price competition.

The substitution relationship between exporting countries highlights the importance of export promotion and trade diplomacy. The Ministry of Maritime Affairs and Fisheries, together with the Ministry of Trade, can strengthen the branding of Indonesian tilapia products as environmentally friendly products. Efforts to strengthen product image through promotion can build positive consumer perceptions. In addition, market research support and assistance for farmers and exporters are needed to tailor product characteristics to global consumer preferences. As a result, these efforts should strengthen Indonesian frozen tilapia fillets' position in global competition.

CONCLUSIONS AND SUGGESTIONS

The findings indicate that Indonesia holds the second-largest share of the global frozen tilapia fillet market, reaching 21.77%, trailing only China. The demand for frozen tilapia fillets in Indonesia is inelastic at -0.649, indicating that consumers are unresponsive to price changes. However, frozen tilapia fillets in Indonesia are classified as inferior goods, so an increase in global consumer income will actually reduce demand by 0.477%. Frozen tilapia fillets from Indonesia, China, Taiwan, the Netherlands, and the USA are substitutes or competitors in the international market. The policy implications of the study results include (1) Competitive pricing strategies through efficiency to reduce production costs and maintain price competitiveness, (2) The government and business actors need to strengthen quality standards through certification and compliance with international regulations, (3) Product diversification to create added value, (4) Export promotion and trade diplomacy to strengthen product image and build positive consumer perceptions. (5) Market research support and assistance for exporters to tailor product characteristics to global consumer preferences. Further research could analyze other tilapia species with potential for the global market. In addition, research could focus on a single export market to yield a more in-depth, comprehensive analysis and policy implications.

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