

A comparative study of Indonesia's tuna export competitiveness to Japan and the United States during 2012–2022

Anissa Aprilia Nurkhasanah^{1*}, Amalia Febryane Adhani Mazaya¹, Supriyadi¹, Dwi Sofiati¹, Harsuko Riniwati², Ahmad Musyafak³ and Rahma Amelia Prayitno¹

¹Faculty of Fisheries and Marine Science, Brawijaya University (PSDKU), Kediri, Jawa, Timur, Indonesia

²Department of Fisheries Agribusiness, Faculty of Fisheries and Marine Sciences, Brawijaya University, Malang, Jawa Timur, Indonesia

³PT Blue Ocean Foods Indonesia (BOFi), Karangploso, Malang, East Java, Indonesia



*Correspondence e-mail:

anissa.a@ub.ac.id

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Abstract

This study investigated the export competitiveness of Indonesian fishery products in the Japanese and United States (U.S. markets over the period from 2012 to 2022. A quantitative analytical framework was employed, integrating Revealed Comparative Advantage (RCA), Export Product Dynamics (EPD), Constant Market Share (CMS), and a log-linear gravity model, complemented by a SWOT assessment. Trade data were sourced from the UN Comtrade database. The RCA results confirmed a sustained comparative advantage, average RCA value exceeding 2.5 in the U.S. market and 1.8 in Japan, indicating a stronger relative competitiveness in the U.S.. The EPD classification identified HS 030487 as a "Rising Star", while several other product groups remained in the "Cash Cow" and "Lost Opportunity" quadrants, reflecting structural vulnerabilities in market positioning. CMS decomposition showed that export growth was predominantly driven by market distribution effects (62%) and product composition effects (27%), whereas competitiveness effects contributed marginally, indicating limited structural upgrading. The gravity model results reveal that Indonesian tuna exports increased by approximately 0.88% with a 1% rise in Indonesia's GDP, and by 0.74% per 1% increase in the importing country's GDP. Conversely, exports decrease by 1.18% with a 1% increased in bilateral distance, underscoring the elasticity of trade flows to economic scale and logistical constraints. These findings indicate that export performance is more responsive to macroeconomic demand conditions and trade costs than to intrinsic competitiveness improvements. The integration of empirical gravity results with SWOT analysis highlights the importance of enhancing logistics efficiency and reducing transport related trade costs to counteract the effects of distance elasticity. Strengthening product certification, quality upgradation, and market diversification are essential to transition products towards high growth segments and capitalise on expanding demand. This study contributes to the literature by linking trade elasticity analysis with strategic competitiveness frameworks in the fisheries export sector.

Introduction

Indonesia as the world's largest archipelagic nation, has substantial fisheries potential and is among the leading global exporters of fishery products (Sunoko and Huang, 2014). The sector contributes significantly to the supply of animal-based protein, particularly fish products, which constitutes an essential economic commodity (FAO, 2020). The fisheries sector serves as the main driver of Indonesia's national economy, with fish, especially tuna being a major component

of international trade. In Indonesia, fish products are marketed in a variety of forms, from fresh and frozen products to processed (canned) products. According to Buana *et al.* (2018), Indonesia accounts for around 16% of global supply of certain processed tuna products. The U.S. and Japan are the two main export destinations that absorb the majority of Indonesia's tuna exports, as both nations have high tuna consumption levels.

In the international arena, export performance is significantly influenced by competitiveness.

A country's ability to sustain and strengthen its position in global markets largely depends on the competitiveness of its products, particularly in the context of intensifying international trade (Widodo, 2009). The global fish market exhibits distinct characteristics, with both emerging and established market segments tending to be highly competitive, while the canned fish market is characterised by an oligopolistic structure dominated by a few major developing nations (Osmaleli *et al.*, 2023). This situation presents Indonesia with both opportunities and challenges in optimising its tuna export strategy for the two major markets such as the U.S. and Japan. Beyond competitiveness, the Indonesian tuna industry must also address several critical issues including, enhancing value addition, ensuring sustainability, and tackling illegal, unreported, and unregulated (IUU) fishing practices that threaten the sustainability of tuna fish stocks (Khan *et al.*, 2024). In order to remain competitive in the expanding global market, Indonesia must improve tuna production efficiency and strategic positioning relative to other major fish-producing nations, such as the Philippines, Thailand, and Ecuador. The U.S. as one of the major global fish export destinations, has trade requirements and market characteristics that differ from those of Japan. The US emphasises cost efficiency and volume, while the Japanese market prioritises premium quality and stringent standards. These differences necessitate distinct market strategies and significantly influence the competitiveness of Indonesian fish exports in both markets. Accordingly, this study aims to analyse the competitiveness of Indonesian tuna fishery exports in the US and Japanese markets, identify the key factor that influence this competitiveness, and establish strategies to enhance Indonesia's competitive position in both markets.

Materials and methods

This study employed a quantitative methodology using secondary data from UN Comtrade database (<https://comtradeplus.un.org/>) for the period 2012 and 2022. The dataset consists of Indonesian tuna export data to the US and Japan, classified under the following HS codes: 030232 yellowfin tuna (*Thunnus albacares*); 030234 bigeye tuna (*Thunnus obesus*); 030341 albacore or longfin tuna (*Thunnus alalunga*) KI-D4 or KI-D7 or KI-D1; 030342 yellowfin tuna (*Thunnus albacares*); 030343 skipjack or stripe bellied bonito; 030344 bigeye tuna (*Thunnus obesus*) and 030487 tuna (of the genus *Thunnus*); skipjack or stripe bellied bonito (*Euthynnus pelamis* or *Katsuwonus pelamis*). The selection of the ten year study period was based on the availability of consistent data and to provide a representative overview of the export trends (Aryudiawan and Suadi, 2022).

Export market share (EMS)

To gauge Indonesia's relative position in the US and Japanese markets, export market share analysis (EMS) was applied. EMS was calculated using the following formula (Mohd Fayaz and Mumtaz, 2020):

$$EMS = (X_{ij} / X_{wj}) \times 100$$

where, EMS = Export market share; X_{ij} = Exports of product i from country j to market k; X_{wj} = Total world exports of product i to country j.

Revealed comparative advantage (RCA)

The comparative advantage of Indonesian tuna exports relative to those of other countries is assessed using Revealed comparative

advantage (RCA) analysis. RCA was estimated using the formula (Oktavilia *et al.*, 2019):

$$RCA = (X_{ij} / X_{it}) / (X_{nj} / X_{nt})$$

where, X_{ij} = Exports of product j from country i; X_{it} = Total exports of country i; X_{nj} = World exports of product j; X_{nt} = Total world exports

An RCA value greater than 1 indicates a comparative advantage, while $RCA < 1$ indicates the absence of comparative advantage.

Constant market share (CMS) analysis

Constant market share (CMS) analysis was used to identify sources of changes in export market share by separating the effects of market growth, commodity composition, and competitiveness. The CMS model used refers to (David, 1971):

$$\Delta X = r \times X_0 + \sum (r_j - r) \times X_{j0} + \sum (\Delta X_{j,t} - r \times X_{j0})$$

where, ΔX = Change in total exports; r = Growth rate of total world trade; r_j = Growth rate of commodity j; X_0 = Exports of base period; X_{j0} = Exports of commodity j of base period

Export product dynamics (EPD)

Export product dynamics (EPD) analysis is used to classify product positions based on market attractiveness and business strength. This method employs a 2x2 matrix based on market share growth and market growth (Yulhar and Darwanto, 2019).

The growth rate of export market share is calculated as:

$$\text{Growth of market share} = \left(\frac{\left(\frac{X_{ij,t} - X_{ij,t-1}}{M_{j,t} - M_{j,t-1}} \right)}{\frac{X_{j,t-1}}{M_{j,t-1}}} \right) * 100$$

where, X_{ij} = Export value of product i from country j, M_j = Total imports of the destination market; t = Current year; $t-1$ = Previous year

Market growth was measured using the growth rate of total imports of the destination country:

$$\text{Market growth} = \left(\frac{M_{j,t} - M_{j,t-1}}{M_{j,t-1}} \right) * 100$$

- Rising star: Market share increases and market increases
- Cash cow: Market share increases and market decreases
- Question mark: Market share decreases and market increases
- Lost opportunity: Market share decreases and market decreases

Gravity model

Trade flows between two nations were analysed using the gravity model of international trade. According to this model, trade between two countries increases with economic size (GDP) and decreases with trade barriers or geographical distance. The gravity model explains the factors affecting the volume and value of Indonesian

tuna exports to the US and Japan by incorporating economic and geographic variables (Sulistijowati *et al.*, 2023):

$$\ln(X_{ijt}) = \beta_0 + \beta_1 \ln(\text{GDP}_{i,t}) + \beta_2 \ln(\text{GDP}_{j,t}) + \beta_3 \ln(\text{Dist}_{ij}) + \beta_4 \ln(\text{POP}_{i,t}) + \beta_5 \ln(\text{POP}_{j,t}) + \varepsilon_{ij,t}$$

where, X_{ijt} = Value of tuna exports from Indonesia (i) to country j in year t

$\text{GDP}_{i,t}$ = Gross domestic product of Indonesia in year t

$\text{GDP}_{j,t}$ = Gross domestic product of destination country (US/Japan) in year t

Dist_{ij} = Geographical distance between Indonesia and destination country

$\text{POP}_{i,t}$ = Population of Indonesia in year t

$\text{POP}_{j,t}$ = Population of the destination country in year t

SWOT analysis

SWOT is a strategic analysis method used to assess both internal and external factors affecting the competitive position of an organisation, industry sector, or country in global trade. This method is very useful in formulating export development and competitiveness strategies, especially in the context of dynamic global markets.

- **SWOT components: Strengths (S):** Positive internal factors that provide a competitive advantage and can be controlled by the organisation or sector being analysed. In the context of tuna exports, strengths include natural resources, technology, human capital and supporting infrastructure;
- **Weaknesses (W):** Internal limitations that hinder performance and require improvement in fisheries exports, such as inadequate management practices, low product quality, or technological limitations.
- **Opportunities (O):** Favorable external elements that can be leveraged to enhance performance, such as global market growth, shifts in consumer preferences, and supportive trade policies;
- **Threats (T):** Unfavourable external conditions that may hinder performance, including increasing global competition, regulatory changes, and environmental sustainability challenges (Zainul and Achmadi, 2022).

Results and discussion

Indonesia's tuna export trade values fluctuated over the period, with the highest value reaching USD 243,262,913 in 2019, followed by a decline to USD 188,684,354 in 2022 (Table 1). The decline in 2022 was primarily associated with reduced exports to the US market. The dominance of the export market share fluctuated throughout the decade. During 2012, Japan accounted for about 56% of Indonesia's tuna export; however, this share declined to 26% by 2020. In contrast, the US experienced a substantial rise from 43.9% in 2012 to 73.6% in 2020, indicating growing demand for Indonesian tuna in the US market. This shift may reflect changes in export demand and adjustments in export strategies by domestic industry actors (Fauzian *et al.*, 2020).

The year 2022 represents a notable change in this trend, with Japan's market share increasing to 47.5%, while the US accounted for 52.5% of the total exports. This shift suggests the influence of both economic and institutional factors, such as trade regulations, global logistics disruptions, or market-specific demand adjustments. Variations in exports to the US may be associated with non-tariff measures and changing consumption patterns in regional markets (Noufaldo and Hendrati, 2024).

At the beginning of the period (2012–2013), Japan was the dominant export destination, accounting for the majority of Indonesia's exports. However, this pattern began to change after 2014, when the share of the US market increased steadily and eventually surpassed Japan. The peak of US market dominance occurred during 2020 and 2021, when US accounted for the largest share of Indonesian tuna exports, while Japan's share declined to its lowest level during the study period. This shift suggests a gradual reorientation of Indonesia's tuna export markets from East Asia toward North America (Fauzian *et al.*, 2020).

The fluctuations observed indicate the need for a flexible export strategy based on market segmentation. The strong growth of the US market highlights its capacity to absorb large tuna export volumes. At the same time, the renewed increase in Japan's share in 2022 suggests continuing opportunities in traditional Asian markets. These findings underscore the importance of market diversification, improvements in product quality, and the development of marketing

Table 1. Market share of Indonesian tuna exports to Japan and the US (2012–2022)

Year	Japan exports (USD)	US exports (USD)	Total exports (USD)	Japan share (%)	US share (%)
2012	82,453,923	64,545,717	146,999,640	56.1	43.9
2013	68,263,619	54,340,579	122,604,198	55.7	44.3
2014	48,823,851	70,949,450	119,773,301	40.8	59.2
2015	43,461,457	73,425,141	116,886,598	37.2	62.8
2016	43,866,399	81,995,118	125,861,517	34.9	65.1
2017	73,008,933	68,712,189	141,721,122	51.5	48.5
2018	68,835,597	146,733,184	215,568,781	31.9	68.1
2019	70,383,676	172,879,237	243,262,913	28.9	71.1
2020	56,158,327	156,489,865	212,648,192	26.4	73.6
2021	62,040,129	171,274,994	233,315,123	26.6	73.4
2022	89,637,508	99,046,816	188,684,354	47.5	52.5

Source: Processed secondary data sources

strategies aligned with the preferences of tuna consumers in different export destinations. Strengthening Indonesia's tuna fisheries export performance may therefore require investments in post-harvest technology, improved traceability systems, and the expansion of trade partnerships in emerging markets (Destiningsih *et al.*, 2020).

The constant market share (CMS) analysis decomposes changes in export performance into four components: Standard growth effect, Market distribution effect, Commodity composition effect, and Competitiveness effect (Table 2). This framework helps identify the primary sources of fluctuations in export performance. The results show that the market distribution effect is considerably stronger for the US market than for Japan, particularly for commodities such as HS 030232 and HS 030234. For example, the market distribution effect for HS 030232 in the US is 1.33, whereas the corresponding value for Japan is only 0.013. This indicates that the growth of Indonesian tuna exports to the US is largely driven by expansion in market demand rather than improvements in export competitiveness. This finding is consistent with previous studies indicating that export expansion in fisheries trade is often driven by market demand conditions rather than competitiveness gains (Mushtaq and Halil, 2007).

The commodity composition effect shows positive values for several HS categories, with particularly strong effects observed for HS 030344 and HS 030487 in the Japanese market. For example, HS 030344 in Japan recorded a composition effect of 1.161, indicating that the structure of Indonesian tuna exports aligns well with the specific demand patterns of the Japanese market. This suggests that Indonesia has been relatively successful in exporting tuna species that correspond to the consumption preferences of destination markets, which represents an important component of product-based competitiveness (Oktaviana *et al.*, 2017).

In contrast, the competitiveness effects are extremely small across most product categories, often approaching zero or even showing slightly negative values. For instance, the competitiveness effect for HS 030232 in Japan is -0.00000185 , indicating that Indonesia's ability to compete through cost efficiency, product quality, or differentiation contributes only marginally to export growth. This

finding suggests that, despite the expansion of export volumes, a large portion of Indonesia's tuna export growth is driven by external market factors rather than intrinsic improvements in competitiveness (Maqbool *et al.*, 2022).

The dominance of market distribution effects over competitiveness effects therefore indicates that Indonesia's tuna export growth is primarily driven by expanding demand in destination markets rather than improvements in production efficiency or technological upgrading. This pattern implies a structural reliance on external market expansion rather than internal productivity improvements. Consequently, policy interventions should prioritise value added processing, technological upgrading, cost-efficiency improvements, and product differentiation strategies in order to strengthen Indonesia's long-term export competitiveness (Porter, 1990; Fagerberg, 1996).

Results of the RCA analysis indicate that Indonesian tuna exports exhibit strong competitiveness in the U.S. market, with RCA values ranging from 1.36 to 3.83 (Table 3). The highest competitiveness was observed for HS 030343 (skipjack tuna), which records an RCA value of 3.83, indicating a strong comparative advantage of Indonesian exports in this product category within the U.S. market. In contrast, the Japanese market demonstrates a more selective competitiveness pattern. While several commodities such as HS 030342, HS 030344, and HS 030487 showed strong comparative advantages with RCA values greater than one, other products remained less competitive. For instance, HS 030232 and HS 030234 recorded RCA values below one (0.96 and 0.97, respectively), indicating weak comparative advantage in the Japanese market.

Overall, these results suggest that the U.S. provides a more favourable market environment for Indonesian tuna exports, both in terms of market absorption capacity and comparative advantage. The weaker competitiveness of certain products in Japan may reflect stricter quality requirements and more specific consumer preferences in that market.

Within the Indonesian fisheries supply chain, limitations in competitiveness are often associated with slower technological innovation, quality constraints, and production efficiency challenges (Aryudiawan and Suadi, 2022). The variation in competitiveness

Table 2. Competitiveness of tuna commodity exports with constant market share (CMS) analysis

HS Code	Country	Standard growth	Market distribution effects	Commodity composition effects	Competitiveness effect
030232	Japan	-0.029	0.013	-0.087	0.000
	US	1.288	1.330	-0.087	0.000
030234	Japan	0.475	0.629	-0.198	0.000
	US	0.509	0.615	-0.198	0.000
030341	Japan	0.951	1.005	0.115	0.000
	US	4.119	3.973	0.115	0.000
030342	Japan	0.126	-1.069	1.150	0.000
	US	0.058	-0.078	0.092	0.000
030343	Japan	0.882	0.681	0.171	0.000
	US	-0.139	-0.357	0.115	0.000
030344	Japan	0.622	0.143	1.161	0.000
	US	-0.587	-1.287	1.053	0.000
030487	Japan	0.630	0.371	0.332	0.000
	US	0.303	0.026	0.227	0.000

Source: Processed secondary data sources

Table 3. Revealed comparative advantage (RCA) of Indonesian tuna exports in the Japanese and US markets

Commodity	Country	Export competitiveness	Competitiveness
030232	Japan	0.96	Weak
	US	1.83	Strong
030234	Japan	0.97	Weak
	US	1.36	Strong
030341	Japan	1.60	Strong
	US	2.43	Strong
030342	Japan	1.65	Strong
	US	3.29	Strong
030343	Japan	0.98	Weak
	US	3.83	Strong
030344	Japan	2.24	Strong
	US	3.40	Strong
030487	Japan	1.29	Strong
	US	1.44	Strong

Source: Processed secondary data sources

across commodities and destination markets highlights the need for targeted export strategies. For commodities that already demonstrate strong competitiveness such as HS 030342 and HS 030344, strategies should focus on market expansion and increased production capacity. Conversely, for products with weaker competitiveness, improvements in product differentiation, quality enhancement, and compliance with technical and non-tariff standards are essential.

Strengthening Indonesia’s tuna export competitiveness therefore requires investments in production efficiency, certification systems, and post-harvest processing technologies (Destiningsih *et al.*, 2020).

The export product dynamics (EPD) analysis was employed to examine the competitive position of Indonesian tuna exports in the Japanese and US markets during the 2012–2022 period. EPD evaluates the performance of export products by combining two indicators, namely the growth of market share and the growth of the destination market’s imports. By plotting these indicators into a two dimensional matrix, products can be classified into four categories: Rising Star, Cash Cow, Question Mark, and Lost Opportunity, which reflect the attractiveness of the market and the competitiveness of the exporting country (Yulhar and Darwanto, 2019). The results indicate that most Indonesian tuna products in both markets fall into the Rising Star category, suggesting that Indonesia is gaining market share while the overall market demand continues to grow (Fig. 1).

Specifically, products such as HS 030234 (US and Japan), HS 030341 (US and Japan), HS 030487 (US and Japan), HS 030343 (US), and HS 030342 (Japan) are categorised as Rising Stars. Additionally, HS 030232 (US) is firmly in the Rising Star quadrant, showing positive market growth and market share gains. This reflects strong competitiveness and favourable opportunities, particularly in the US market. (Estu *et al.*, 2019). Trading markets that consistently rank in the Rising Star position have a solid relationship with product quality, supply chain effectiveness, and focused on national branding strategy (Agustia and Hendrati, 2024).

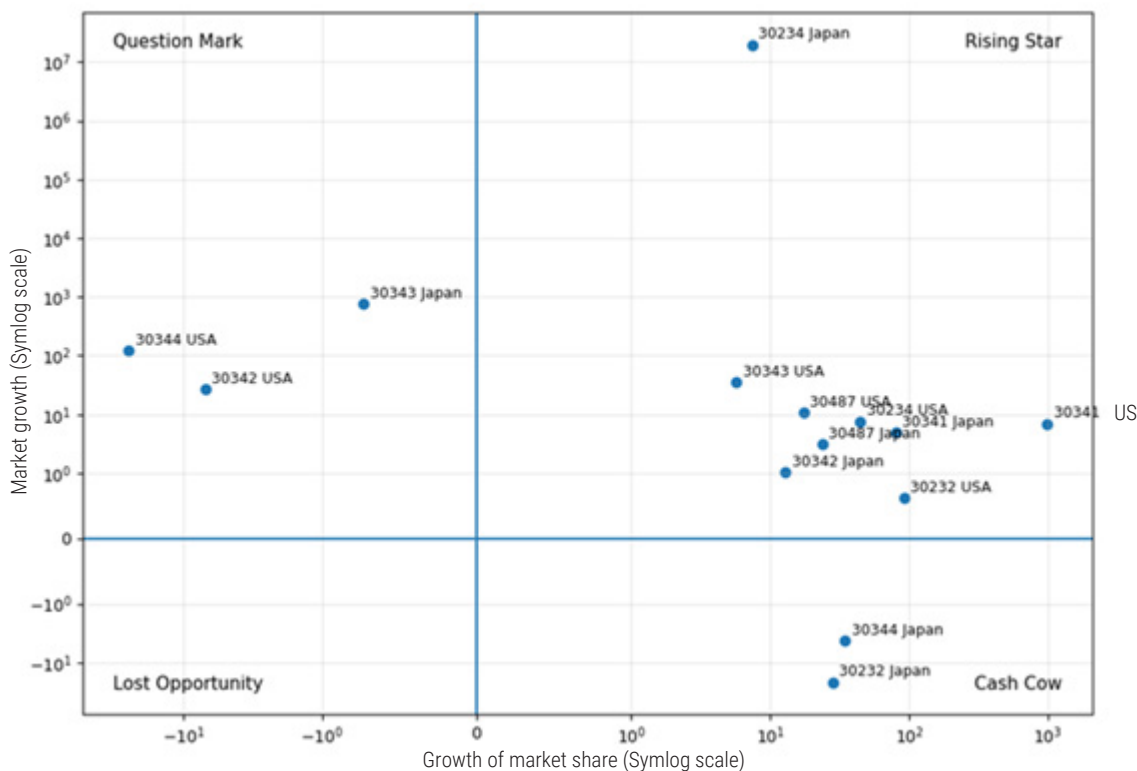


Fig. 1. EPD matrix of Indonesian tuna exports to Japan and the US (2012-2022)

On the other hand, some products are classified as Cash Cow and Question Mark. For instance, HS 030232 and HS 030344 in Japan fall into the Cash Cow category, indicating that although Indonesia's market share is increasing, the overall market demand is declining. Meanwhile, HS 030342 (U.S.), HS 030343 (Japan), and HS 030344 (US) are categorised as Question Mark, meaning that the market is growing but Indonesia's share is declining. This suggests that Indonesia faces stronger competition from other exporting countries in these product segments. Overall, the EPD results imply that Indonesia maintains a strong competitive position in the global tuna trade, particularly in products categorised as Rising Star, which represent promising opportunities for further export expansion in both Japan and the US.

The gravity model estimation results indicate that the model is statistically significant in explaining the determinants of Indonesian tuna exports (Table 4). The coefficient of determination ($R^2=0.87$) suggests that approximately 87% of the variation in export values can be explained by changes in Indonesia's GDP, the GDP of the destination country, and the geographical distance between Indonesia and its trading partners. Furthermore, the F-statistic probability value ($p<0.01$) indicates that the model is statistically significant at 1% level.

Table 4. Gravity model estimates for Indonesian tuna exports to Japan and US

Variables	Coefficient	SE	p value
Intercept	10.45	1.12	0.000
Ln (GDP Indonesia)	0.88	0.27	0.003
Ln (GDP Country of destination)	0.74	0.22	0.004
Ln (Distance)	-1.18	0.39	0.012
R-squared	0.87		
Prob (F-stat)	0.0	(significant at 1% level)	

The coefficient for Indonesia's GDP is 0.88 ($p=0.003$), indicating that a 1% increase in Indonesia's GDP is associated with an approximately 0.88% increase in tuna export value, holding other variables constant. This result suggests that domestic economic expansion and production capacity play an important role in supporting export performance. Similar findings have been reported in previous studies on fisheries trade (Saptanto and Widyono, 2010).

The GDP of the destination country also has a positive and statistically significant effect, with a coefficient of 0.74 ($p=0.004$). This indicates that higher economic growth importing countries increases the demand for Indonesian tuna exports. Countries with

stronger purchasing power and expanding economies generally exhibit higher consumption of fishery products.

Conversely, geographical distance shows a negative and statistically significant coefficient of -1.18 ($p=0.012$), implying that greater distance between Indonesia and its trading partners reduces export volumes. This finding is consistent with the core prediction of the gravity model, which posits that distance acts as a proxy for transportation costs, logistics constraints, and other trade frictions. Previous studies have similarly emphasised the role of geographic distance and logistics performance in determining export flows (Wahyu, 2020). The initial gravity specification included population variables for both exporting and importing countries. However, since these variables were not statistically significant, they were excluded from the final model to obtain a more parsimonious specification.

Thus, the final model in this study can be written as follows:

$$\text{Log}(\text{Exp}_{it}) = 10.45 + 0.88 \log(\text{GDP}_{IND}) + 0.74 \log(\text{GDP}_j) - 1.18 \log(\text{Distance}_{ij}) + \epsilon$$

These results suggest that economic growth and trade costs are key determinants of Indonesia's tuna export performance. Improving logistics efficiency and transportation infrastructure may help mitigate the negative effects of geographical distance, while expanding access to high-income markets can further strengthen export growth.

Indonesia possesses several key qualities in tuna exports that make it a significant player in South-east Asia. Indonesia's fish production is among the highest in the region, supported by extensive fishing grounds in tropical waters. Furthermore, diverse export commodities, including yellowfin tuna, bigeye tuna, skipjack tuna, and albacore tuna, offer the flexibility to accommodate the requirements of different market segments. A major trade destination for a long time, the Japanese market is renowned for its high selectivity and appears to maintain stable demand. A competitive edge in production cost structures is also offered by relatively cheap local labor costs (Saptanto and Soetjitpto, 2017).

Despite its enormous potential, Indonesia's fish trade still faces a number of issues, including a heavy reliance on important markets like the US and Japan, which makes the sector vulnerable to changes in partner countries' trade policies. In addition, the distribution of logistics infrastructure, including fishing ports and refrigeration facilities, is unequal across production centers. Quality certification and compliance with universal standards have not been consistently implemented, which has impeded access to premium markets. Overfishing and seasonal fishing patterns are

Strengths (S)

- Indonesia has the largest fish production volume in South-east Asia
- Product development (Yellowfin, Bigeye, Skipjack)
- The Japanese market is steady and well established
- Competitive domestic labour costs

Opportunities (O)

- Increasing seafood consumption in the US market
- High purchasing power in developed markets such as Japan and the US
- Rising global demand for sustainable seafood products
- Expanding international trade cooperation and market access

Weaknesses (W)

- High dependence on major markets (US and Japan)
- Export logistics infrastructure remains limited
- Quality certification and international standards are still uneven
- Production fluctuations due to seasons and overfishing

Threats (T)

- Extreme competition from Vietnam, Philippines, and Thailand
- Taxes and NTBs (non-tariff boundaries) within the US/Japan
- Expansion of coordination and ocean transportation costs
- Global exchange rate and market volatility (such as the impact of COVID-19)

among the factors that cause annual production levels to fluctuate unpredictably.

The demand for fishery products in the market is on the rise, particularly in the US, which is experiencing a trend toward healthful, protein-rich diets. The Regional Comprehensive Trade Association (RCEP) and the ASEAN Products Trade Association (ATIGA) are examples of free trade agreements (FTAs) that offer expanded access through preferential import tariffs. Advances in processing technology, such as eco-friendly packaging and quick freezing methods, also provide opportunities to increase the added value of exported products.

In terms of both quality and cost, competition from other developing countries, including the Philippines, Vietnam, and Thailand, is substantial. The infrastructure and certification systems of these countries are more developed and better integrated. Additionally, the presence of tariffs and non-tariff barriers (NTBs) from destination nations, such as sanitary and phytosanitary (SPS) measures and labeling requirements, are considerable obstacles. Global instability, including fluctuations in exchange rates and the effects of the COVID-19 pandemic, further increases uncertainty in international trade flows (Alhayat, 2012).

The SWOT analysis revealed four fundamental approaches for enhancing the competitiveness of Indonesian fish exports, which relies on a combination of internal and external components (Table 5). The Qualities Openings (S-O) methodology emphasises the importance of utilising Indonesia's fundamental qualities and production capabilities to capitalise on global opportunities. Indonesia's diversified fish species (yellowfin, skipjack, bigeye) and its status as the largest fish supplier in South-east Asia are critical assets for the development of export markets in non-traditional regions, including the EU and South Korea. Furthermore, value-added processes through cold chain technology, logistics digitisation, and traceability systems can improve access to premium markets that require high-quality standards. Within the shortcomings, Dangers (W-T) procedure, product and market expansion are the recommended strategies. Expanding into potential non-traditional countries, such as the UAE, Russia, and Turkey, can mitigate dependence on the US and Japanese markets. In order to guarantee supply chain transparency, enhanced market confidence, and mitigate the risk of non-tariff barriers, it is essential to digitise the traceability framework during expansion (Harahap and Widyastutik, 2020).

Table 5. SWOT analysis of Indonesian tuna export performance

Strategy	Recommendation
S-O	Optimise cold chain technology and export added value.
	Use production advantages to expand into alternative markets (Korea, EU).
W-O	Improve HACCP/MSC certification for exports to premium markets.
	Invest in fishing port-based export logistics infrastructure.
S-T	Lobby for free trade agreements (FTAs) to reduce tariffs.
	Strengthen branding of Indonesian tuna products to compete with ASEAN exporters.
W-T	Diversify markets and products (fillet, processed, canned).
	Digitise the traceability system.

Indonesia demonstrates strong export competitiveness in the global tuna market, particularly in the US. The RCA analysis indicates that most tuna commodities have RCA values greater than one, suggesting a strong comparative advantage. TEPA results show that the commodity with HS code 030487 is classified as a Rising Star, while several other commodities remain in other categories. TCMS analysis reveals that export growth is primarily driven by market distribution effects and product composition rather than intrinsic competitiveness. Meanwhile, the Gravity Model results indicate that the economic size of the destination country (GDP) and geographical distance significantly influence export volumes. Based on the SWOT analysis, several strategic recommendations are proposed, including optimising production and logistics technology, diversifying export markets and products, and improving quality standards and certification to strengthen Indonesia's competitive position in the global tuna market.

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