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UNLEASHING THE EFFICIENCY AND POTENTIAL OF INDONESIAN FISHERY EXPORTS TO THE EUROPEAN UNION MARKET

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Abstract: The free trade agreement (FTA) between Indonesia and the EU is anticipated to boost Indonesia's economic growth, particularly in trade. However, from 2020 to 2022, EU countries issued 38 notifications concerning Indonesian exports, primarily related to sanitary and phytosanitary measures, which are non-tariff barriers in free trade. Indonesia has not benefited from the positive trend in EU fishery commodity imports. This study addresses the research gap on the efficiency and export potential of Indonesian fishery products in the EU market. It aims to assess factors influencing trade flow, export efficiency, and export potential of Indonesian fisheries to the EU using the stochastic frontier gravity model (SFGM). The SFGM in the gravity model determines the maximum potential trade level achievable in bilateral trade. This research utilized panel data on Indonesian fishery exports to the EU-27 countries from 2003 to 2021 (19 years). This study analyzed the HS 03 products—fish, crustaceans, mollusks, and other aquatic invertebrates—exported from Indonesia to 25 EU countries. The results indicated that the GDP of both exporting and importing countries, competitiveness and the exchange rate of the rupiah against the US dollar positively impacted fishery exports to the EU. Conversely, distance, represented by trade costs, negatively impacted Indonesia's fishery exports in the EU. The findings showed Indonesia did not have a 100% efficiency value. The highest market potential for Indonesia in the EU was in exporting fishery products to France, Italy, Germany, Austria, and Spain.

Key words: export, European Union, fisheries, Indonesia, trade efficiency, trade potential.

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Introduction

The openness of the global market has encouraged every country to increase its participation in the global market. A country's participation is determined by its competitiveness (Abukari and Cunfeng, 2021; Sa'diyah and Darwanto, 2020) and the relations between countries (Guan and Ip Ping Sheong, 2020) which have a positive influence on the trade balance. Global market openness is followed by the increased implementation of free trade agreements (FTAs). The FTA is a collaboration consisting of 3 main components, namely trade in goods, trade in services and investment. The FTA is structured to reduce the application of trade tariffs, quotas and trade barriers to a group of products, or to all products traded. The application of this FTA is expected to be an effort to increase trade among countries, which is the result of easing and reforming of the bureaucracy that can remove institutional and economic barriers (Kepaptsoglou et al., 2010). Over the past 25 years, Indonesia has implemented FTAs in the international market in the form of multilateral, regional and bilateral agreements (Purwono et al., 2022). By 2021, Indonesia had had 40 FTAs (CSIS Indonesia, 2021). The application of FTA in Indonesia is expected to strengthen relations among countries, which can increase the flow of Indonesian trade to FTA partner countries.

One of Indonesia's main trading partners in the international market is the European Union (EU). Indonesia's trade balance with the EU has a surplus value although it fluctuates every year (CSIS Indonesia, 2021). Indonesia's export growth rate to the EU reached 33.53 percent in 2021. The value of Indonesia's exports with the EU reaches US$ 19,243,110,000, with agricultural commodities accounting for the largest proportion of 33.85 percent. Even though the growth rate of Indonesia's export to EU countries is relatively high, Indonesia's market niche in the EU market is still relatively low compared to other major exporting countries. The Indonesian market niche in the EU market was only 1.03 percent in 2021 (Trade Map, 2023). When compared to other ASEAN countries, Indonesia is still lagging behind in controlling the EU market niche. Although the Indonesian market niche has a positive trend, the increase has not been significant and is still lower compared to Singapore, Vietnam, Malaysia, and Thailand (Figure 1).

The implementation of the FTA between Indonesia and the EU is expected to be a catalyst for Indonesia's economic growth, particularly in the trade sector. Theoretically, FTAs increase trade flows between the two partners (Ingot and Hastjarjo, 2017). Therefore, Indonesia wants to work with the EU to enhance economic diplomacy through the Indonesian-European Union Comprehensive Economic Partnership Agreement (IEU-CEPA). The IUE-CEPA will hopefully reduce various existing trade barriers, so that Indonesian products will become competitive and diversified (CSIS Indonesia, 2021). For the 2020–2022 period, there were 38 notifications assigned by EU countries for Indonesian export

products (RASFF, 2023). The majority of the notifications were related to sanitary and phytosanitary measures, which are a non-tariff measure in free trade. As much as 24 percent of notifications were imposed on Indonesian fishery products exported to the EU market (RASFF, 2023). This causes Indonesia to lose trade potential that can be realized in the EU market.

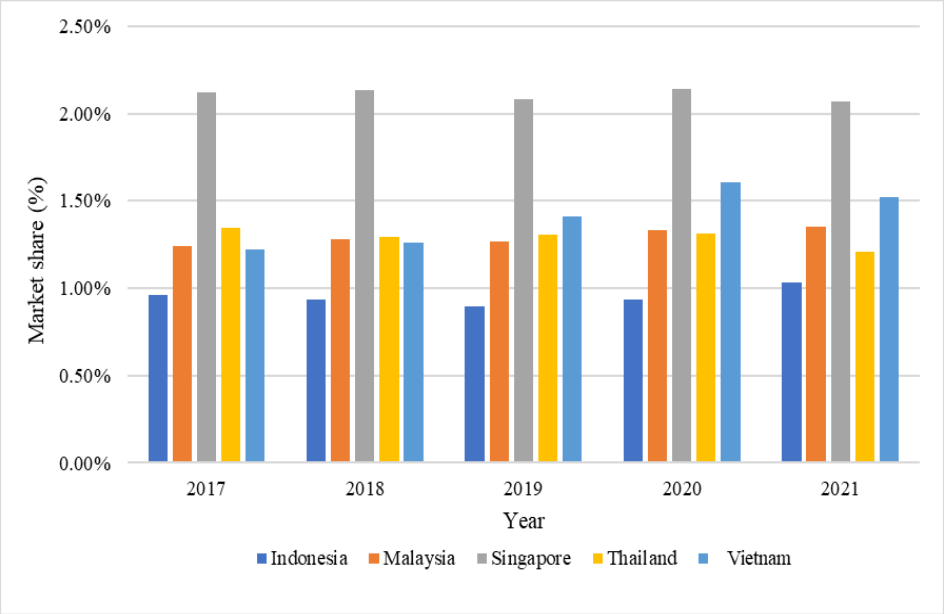

Figure 1. The market share of ASEAN members in the EU market.

On the other hand, the import value of fishery products in the EU reached US$ 48,442,785,000 in 2021 (Figure 2). Imports of EU fishery products have a positive trend with a growth rate reaching 17.68 percent in 2020–2021 (Trade Map, 2023). This condition illustrates that the potential for developing the fishery sector in the EU is still open. In terms of production, Indonesia has a comparative advantage in the utilization of fishery resources. Indonesia is one of the top 15 countries with the largest number of fish catches in the world (Laksani, 2019) with a maximum sustainable yield potential of around 6.4 million tonnes per year (Rasyid, 2015). However, the positive trend in EU fishery commodity imports has not been fully utilized by Indonesia, with fishery production also having a positive trend.

Several studies have been conducted to analyze the competitiveness of Indonesian fishery products in the international market using the revealed comparative advantage (RCA) and constant market share (CMS) methods in the international market (Aisya et al., 2017), the ASEAN-China market using the RCA method (Saptanto, 2011), and in the ASEAN-Canada market using the RCA,

Export Product Dynamic and X-Model Product Export Potential methods (Luhur et al., 2019). Other research analyzed the export opportunities of fishery products in the EFTA market using a descriptive statistical approach and a trade potential indicator (Salam and Lingga, 2017) and a strategy to increase exports of fishery and marine products in the EU market using a SWOT analysis approach (Ali Mursit et al., 2022).

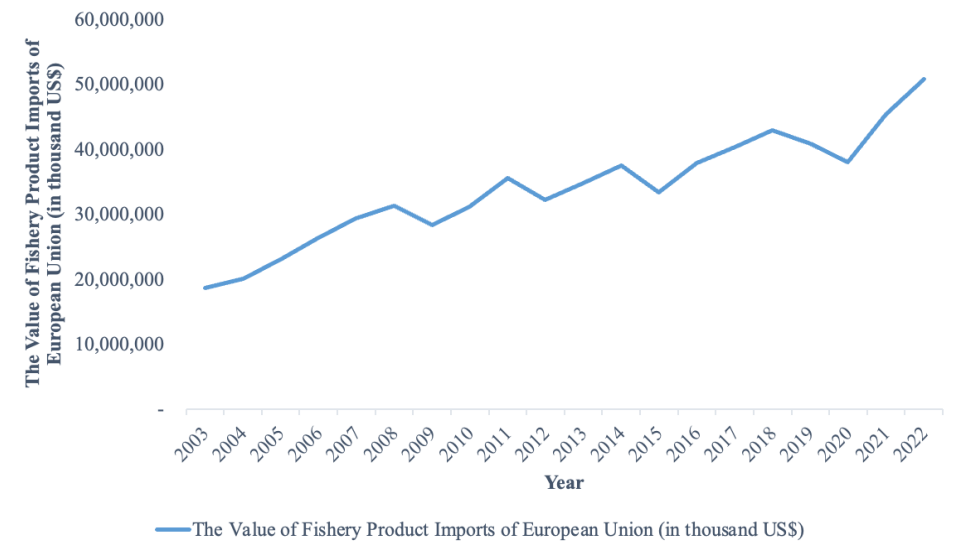

Figure 2. The value of fishery product imports of the European Union (in thousand US$).

In addition, other studies examine the factors affecting trade in the Indonesian fishery sector in international markets using a gravity model approach (Saragih et al., 2022; Hidayati et al., 2015; Saptanto and Soetjitpto, 2017) as well as research analyzing trade barriers in the form of tariff (Adam, 2018; Laksani, 2019) and non-tariff (Handoyo, 2019; Laksani, 2019) policies. The research conducted so far has not yet reached the stage of analyzing the efficiency of exports of Indonesian fishery products to the EU market as Indonesia's main trading partner in the international market. Export efficiency shows the level of resistance of a trade flow (Ravishankar and Stack, 2014) and the capability of a country to benefit from regional market integration (Tamini et al., 2018). Therefore, this study was designed to fill the current research gap relating to the efficiency and export potential of Indonesian fishery products in the EU market. The purpose of this study was to analyze the factors influencing the flow of Indonesian fishery trade, export efficiency and the export potential of Indonesian fishery in the EU market by using the stochastic frontier gravity model approach.

Material and Methods

Empirical model/Gravity model

This study used a specific gravity model to estimate the factors influencing exports of fishery products to the EU market. The standard form of the gravity equation is calculated as follow (Anderson and Van Wincoop, 2003; Balogh and Leitão, 2019; Bergstrand, 1989; Blanes, 2005):

$$EXPORT_{ij,t} = \beta_0 \times \frac{GDP_{i,t}^{\beta_1} \times GDP_{j,t}^{\beta_2}}{DIS_{ij,t}^{\beta_3}} \times \varepsilon_{ij} \quad \text{(Eq.1)}$$

$EXPORT_{ij,t}$ is the value of Indonesian fishery product export to importing country j at time t; $GDP_{i,t}$ and $GDP_{j,t}$ are proxies for the size of the economy of the country conducting bilateral trade at time t; $DIS_{ij,t}$ is a variable describing the distance between two countries conducting bilateral trade and the error term is ε_{ij}^{t} (Ravishankar and Stack, 2014). The gravity model is the most frequently used model in research related to international trade to estimate the factors influencing bilateral trade (Boughanmi et al., 2021). The parameters of the majority gravity model were estimated using data from a group of countries reflecting normal trade relations. However, this model had a weakness because the potential for increased trade between countries was only expressed by the average sample used, but not by the maximum amount that each country could achieve in the market. Transforming Equation 1 into a linear form for Indonesian fishery product exports can be achieved by taking the natural logarithm, as demonstrated by the following expression:

$$ln\ EXPORT_{ij}^{t} = \beta_0 + \beta_1 ln\ GDP_i^t + \beta_2 ln\ GDP_j^t - \beta_3 ln\ DIS_{ij} + \varepsilon_{ij} \quad \text{(Eq. 2)}$$

When measuring trading potential using the average value of samples in a model, it is difficult to achieve optimal values because the predicted value of the gravity model continues to decrease when trade data far from the average value is included in the model (Abdullahi et al., 2021a; Abdullahi et al., 2022). An alternative to overcome this problem (Belotti et al., 2013; Kalirajan, 2007; Kumbhakar et al., 2015) is to introduce the stochastic frontier analysis (SFA) approach to explain the trade potential in the gravity model. The SFA approach

used in the gravity model is the maximum potential level of trade that can be achieved through bilateral trade. This approach compares the magnitude of trade in the sample countries with the predicted frontier values of the trading partners, so that the maximum potential trade capacity between these countries is determined (Atif et al., 2017a).

Stochastic frontier gravity model (SFGM)

The development of the gravity model estimated using SFA was developed through research (Aigner et al., 1977; Meeusen and Broeck, 1977), which estimated the technical efficiency of the production function. SFA can provide an overview of the maximum output obtained from a number of optimal inputs (Abdullahi et al., 2021a). Unlike the SFA in the production function, the stochastic frontier gravity model (SFGM) has a different basic form, which is typically that of the traditional SFGM:

$$T_{ijt} = \alpha + \beta_i X_{ijt} + v_{ijt} - u_{ijt} \quad \text{(Eq.3)}$$

Within the stochastic frontier gravity model, T_{ijt} is the actual trade volume, T^*_{ijt} is trade potential. Trade potential represents the optimal trade scale from country i to country j in t period and TE_{ijt} is the technical efficiency of country i to country in year t and can be written as follows (Jiang et al., 2022a):

$$T_{ijt} = f(X_{ijt}, \alpha) exp(v_{ijt}) exp(-u_{ijt}) u_{ijt} \geq 0 \quad \text{(Eq.4)}$$

$$lnT_{ijt} = \ln f(X_{ijt}, \alpha) + v_{ijt} - u_{ijt}, u_{ijt} \geq 0 \quad \text{(Eq.5)}$$

$$T^*_{ijt} = f(X_{ijt}, \alpha) exp(V_{ijt}) \quad \text{(Eq.6)}$$

$$TE_{ijt} = {T_{ijt}}/{T_{ijt}{}^*} = exp(-u_{ijt}) \quad \text{(Eq.7)}$$

In this case, X_{ijt} represents the variables determined to have an influence on the actual trade. This is in accordance with the theory of gravity, namely GDP, distance, and others. Further, α represents an unidentified parameter vector. Then,

v_{ijt} represents deviations in the estimates caused by factors that cannot be controlled, for example, statistical errors and meet the normality criteria. Moreover, u_{ijt} shows the non-efficiency of trading. This measures the factors influencing trade resistance not included in the model built, such as government policies, tariff levels and others (Abdullahi et al., 2021b). When the value of $u_{ijt} > 0$, the bilateral trade that occurs can be categorized as having a non-efficient effect on trade, and the value of $TE_{ijt} \in (0,1)$ describes the level of actual trading, which is smaller when compared to the potential trading volume. If the value of $u_{ijt} = 0$, there is no trade non-efficiency bilateral trade and if $TE_{ijt} = 1$, the actual level of trade is equal to the sum of the potential trade volume of each country (Jiang et al., 2022b).

This study used SFGM with time variation. In this model, a transformation from the conventional gravity model (Equation 2) to SFGM with varying time was carried out in order to estimate the trade of Indonesian fishery products in the EU market. The equation was arranged as follows:

$$ln\, EXPORT_{ij}^{t} = \beta_0 + \beta_1 ln\, GDP_i^t + \beta_2 ln\, GDP_j^t - \beta_3 ln\, DIS_{ij} + \beta_4 RSCA_{ij}^t + \beta_5 EXRATEINDO_{ij}^t + \beta_6 CPI_j^t + v_{ij}^t - u_{ij}^t \quad \text{(Eq.8)}$$

Equation 9 is almost the same as Equation 2 in this study, but Equation 9 divides the error term ε_{ij}^t into two segments. In this case, V_{ij}^t indicates statistical interference in measuring errors and factor inefficiencies, while U_{ij}^t indicates measurements of trading performance. $EXPORT_{ij}^t$ is the Indonesian fishery

product export to importer country at time t; GDP_i^t and GDP_j^t are the gross domestic product of Indonesia and importer countries to proxies for the size of the economy of the country conducting bilateral trade at time t; DIS_{ij} is a variable describing the distance between two countries conducting bilateral trade; $RSCA_{ij}^t$ is the revealed symmetric comparative advantage, which is an index of the competitiveness of Indonesian fishery commodities in the international market at time t. The value of the RSCA was generated from the calculation of the RCA (Balassa, 1965) and RSCA (Laursen, 2015), which was calculated as follows:

$$RCA_{ij} = {x_{ij}/x_i}\Big/{X_{wj}/X_w} \quad \text{(Eq.9)}$$

$$RSCA_{ij} = {RCAij - 1}/{RCAij + 1} \quad \text{(Eq.10)}$$

where x_{ij} is the export value of the j[th] product in the i[th] country or region; x_i is the total export volume of all products in the i[th] country or region; X_{wj}j is the total output of the j[th] product in the world and X_w is the total export value of all products in the world. Furthermore, $EXRATEINDO_{ij}^t$ is the variable exchange rate of the Indonesian rupiah against the US Dollar as one of the currencies in international trade in year t; CPI_j^t is the importing country (EU) consumer price index variable in year t.

Based on the results of parameter estimation, this study calculated the technical efficiency using the equation (developed by Battese and Coelli, 1988 and Coelli et al., 1998) as follows:

$$E[exp(-u_{ijt})|v_{ijt} + u_{ijt}] = \left[\frac{1-\Phi[\sigma_\alpha + \gamma(v_{ijt}+u_{ijt})/\sigma_\alpha]}{1-\Phi\gamma(v_{ijt}+u_{ijt})/\sigma_\alpha}\right] \times exp\left[\gamma(v_{ijt}+u_{ijt}) + \frac{\sigma_\alpha^2}{2}\right] \quad \text{(Eq.11)}$$

Using this equation model, the technical efficiency can be estimated for each importing country with a value between 0 and 1. The value of technical efficiency is equal to 1, therefore, actual and potential trades are the same. If the efficiency

value is close to 0, then the actual trade is below the potential trade level. This creates opportunities for exporting countries to increase their trade (Ahmad Hamidi et al., 2022). The export potential can be assessed using the following equation (Xu et al., 2023):

$$Potential\ export_{ijt} = \frac{Actual\ export_{ijt}}{Export\ efficiency_{ijt}} \quad \text{(Eq.12)}$$

Type and source of data

This study utilized panel data describing trade in Indonesian fishery products to the EU-27 countries in 2003–2021 (19 years). This study used HS 03, which were products from fish and crustaceans, mollusks, and other aquatic invertebrates. After analyzing the trade data on Indonesian fishery products on the EU market, 25 EU countries were selected as samples in this study. This was due to data limitations. A more detailed description of variables, sources, references, and signs expected in the SFGM model can be found in Table 1.

Table 1. Variables in the SFGM model.

Variable explanatory	References	Unit	Source of data
$EXPORT_{ij}^{t}$	(Abdullahi et al., 2021b; J. Xu et al., 2022)	US$	Trade Map (2023)
GDP_{i}^{t}	(Ebaidalla and Ali, 2022; Jiang et al., 2022b; Supriana et al., 2022)	US$	World Bank (2023)
GDP_{j}^{t}	(Ebaidalla and Ali, 2022; Jiang et al., 2022b; Supriana et al., 2022)	US$	World Bank (2023)
DIS_{ij}	(Ebaidalla and Ali, 2022; Jiang et al., 2022b; Supriana et al., 2022)	Km	UNESCAP (2023)
$RSCA_{ij}^{t}$	(Supriana et al., 2022)	Index	Author's calculation
$EXRATEINDO_{ij}^{t}$	(Abdullahi et al., 2021b; Atif et al., 2017b)	Rp/US$	World Bank (2023)
CPI_{j}^{t}	-	Index	World Bank (2023)

Results and Discussion

The export performance of Indonesian fishery products in the European Union market

During the 2003–2021 period, Indonesia's export performance of fishery products in the EU market showed a negative trend (Figure 3). The highest decline in this period was recorded in 2019. The corrected growth of exports of fishery products in 2019 was -23%, with an export value of only US$ 177,807,000. The

year of 2019 was the start of COVID-19. COVID-19 was a major problem for world trade. This condition is in line with the research conducted by Cao et al. (2021) and Demirci et al. (2020). According to Cao et al. (2021), COVID-19 has a negative effect on trade in the majority of agricultural products due to disruptions in the supply chain. This condition is also confirmed by the results of the research conducted by Demirci et al. (2020). The negative impact of COVID-19 on trade in agricultural products on international markets could reach 65%. The short-term crisis in the fisheries sector caused by COVID-19 will be followed by long-term impacts (Amaralal et al., 2023). Therefore, special policies were needed to improve the performance of Indonesian fisheries in the EU market.

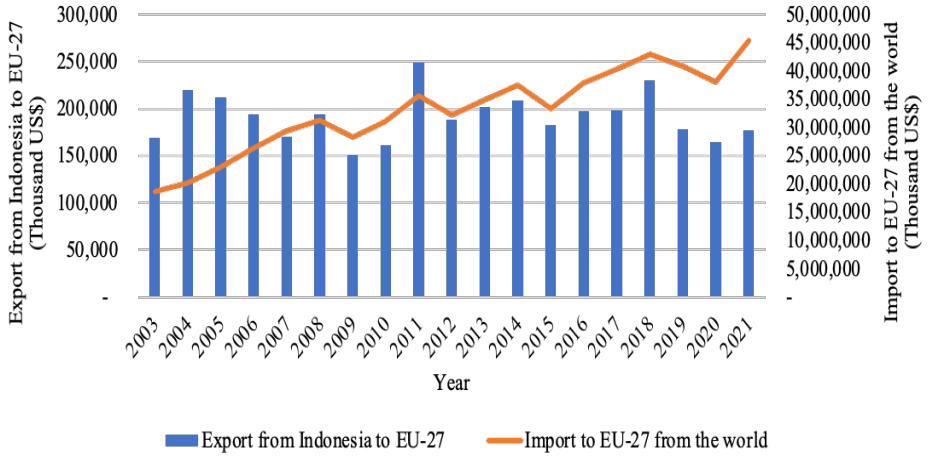

Figure 3. The export value of Indonesian fishery products to the EU market (thousand US$ in current price).

On the other hand, imports of fishery products from EU countries showed a positive trend in 2003–2021 (Figure 3). This condition illustrated that the need for fishery products in the EU market was still very high. EU imports of fishery products returned to higher levels compared to the previous year following the COVID-19 shock. The import value of EU fishery products reached US$ 45,400,394,000 in 2021. Hopefully, Indonesia's exports will increase in the following year and follow the trend of imports of fishery products to the EU.

Indonesia's fishery exports to the EU market consisted of 5 main commodities, namely shrimp, mollusks, fish fillets, frozen fish, and live fish (Figure 4). These five commodities formed the backbone of Indonesia's fishery exports to the EU market. The development of this industry could increase the trade of Indonesian fishery products in the international market. Shrimp had the largest export value with an average value of US$ 64,022,150.

Factors affecting exports of Indonesian fishery products to the EU market

The SFGM model in this study used the maximum likelihood estimator (MLE). The estimation results are shown in Table 2.

Table 2. Results of SFGM parameter estimation.

Variables	Coefficient	Std-error	p-value
Const	-29.68	3.49	0.000*
Ln GDPit	0.34	0.09	0.000*
Ln GDPjt	1.03	0.06	0.000*
Ln DISij	-0.30	0.11	0.006*
RSCA	2.23	0.06	0.000*
EXRATEINDO	1.19	0.19	0.000*
CPIj	-0.01	0.00	0.248
σ_{α}^{2}	1.12	0.37	0.000*
γ	0.86	0.05	
μ	1.93	0.38	0.000*
η	-0.03	0.00	0.000*

In order to test the strength of the SFGM in explaining the factors affecting exports of Indonesian fish products to the EU market, a test phase was required. First, the value of the coefficient γ, which was close to 1 (0.86), meant a random proportion in output, which was explained by the effect of inefficiency or differences in technical efficiency (Ogundari, 2008). This also strengthens the claim that the SFGM built has been able to explain variations in exports of Indonesian fishery products to the EU market (Vinh, 2022). Second, a statistically significant value of σ_{α}^{2} indicates that the model has fulfilled the due diligence test (Tandra et al., 2021).

The SFGM estimation results revealed that the main variable in the gravity model had a significant influence on the exports of Indonesian fishery products to the EU market. The GDP of the exporting country and the GDP of the importing country had a positive influence on the exports of fishery products to the EU market. Countries having a larger GDP value usually have more traded products (Abdullahi et al., 2022). The results of this study are in line with the research conducted (Handoyo, 2019; Khaliqi et al., 2018; Xu et al., 2023). The parameter coefficients obtained from the estimation results showed that a 1% increase in the GDP of the exporting country and the GDP of the importing country increased Indonesia's fishery commodity exports to the EU by 0.34% and 1.03%, respectively.

The GDP of the exporting country and the GDP of the importing country had a positive effect, while distance had a significant but negative effect. The negative effect generated by distance is in accordance with the gravity model created earlier. In this case, according to Tinbergen (1962), distance has a negative effect on bilateral trade between countries. The farther the distance between the two countries conducting

trade, the greater the trade costs incurred, which results in a decrease in the value of exports (Ahmad Hamidi et al., 2022). The findings of the parameter coefficients indicated that as the distance between the countries increased, the exports of the two countries decreased. Specifically, Indonesian exports of fishery products are expected to fall by 0.3% if the distance increases by 1%. The value of the change caused by an increase in trade costs was found to be relatively small because the effect of the change on the decline in Indonesia's fishery exports to the EU market was less than 1%. These results are in line with research conducted by Abdullahi et al. (2021a), Abdullahi et al. (2021b), Ahmad Hamidi et al. (2022) and Supriana et al. (2022).

This study also included other variables outside the main gravity model variables. The researcher added the RSCA, EXRATEINDO and CPI variables. The RSCA stands for the competitiveness of a traded product. The more competitive a product is in the market, the more frequently this product is traded (Dhamira et al., 2021; Suhana et al., 2016). The results of the study demonstrated that the RSCA had a significant positive effect on the exports of Indonesian fishery products to the EU market. The regression coefficient showed that an increase in product competitiveness would increase exports of Indonesian fishery products to the EU by 2.23%. The competitiveness of Indonesian fishery products in the EU market had a positive trend. This was illustrated by the increase in Indonesia's market niche in the EU market, which increased year by year. These results are in line with the research conducted by Supriana et al. (2022).

The rupiah exchange rate against the US dollar was also variable in this study. The results of this research are in line with research of Tandra et al. (2021), who state that the depreciation of the rupiah against the US dollar will increase export competitiveness. This is due to the depreciation of the national currency, which makes the price of exported goods cheaper compared to competing countries with stronger currencies. An increase in the rupiah exchange rate against the US dollar by 1% would increase exports of Indonesian fishery products to the EU by 1.19%. In addition, the consumer price index (CPI) of the importing country had no effect on Indonesia's fishery exports to the EU market.

Efficiency and export potential of Indonesian fishery products in the EU

Furthermore, this study calculated the value of technical efficiency (TE) based on the SFGM developed to analyze the exports of Indonesian fishery products to the EU market. The results of the TE values (Table 3) were the average values of all samples in 2003–2021. The calculation results show that Indonesia did not have an efficiency value of 100%. This condition illustrates that Indonesia and the EU countries have not carried out trade optimally (Ahmad Hamidi et al., 2022). The existence of trade barriers in the form of tariff and non-tariff policies can be the reason why the flow of trade in Indonesian fishery products has not reached the maximum conditions (Khaliqi et al., 2018; Thuong, 2018).

Table 3. The TE value of Indonesia's fishery product exports to the EU market.

No.	Country	TE	No.	Country	TE
1	Netherlands	85.83	14	Denmark	11.10
2	Belgium	65.09	15	Germany	11.20
3	Estonia	52.71	16	Hungary	9.33
4	Cyprus	45.69	17	Finland	9.70
5	Slovenia	40.76	18	Lithuania	8.42
6	Malta	30.09	19	Czech Republic	8.33
7	Spain	26.59	20	France	7.98
8	Portugal	19.46	21	Sweden	6.20
9	Italy	17.79	22	Romania	4.99
10	Greece	14.30	23	Ireland	4.66
11	Croatia	12.72	24	Slovakia	3.42
12	Poland	13.85	25	Austria	2.10
13	Bulgaria	11.17			

Table 4. Potential exports and GAP of Indonesian fishery products in the EU market (US$ million).

Importing country	Actual	Potential	GAP	Importing country	Actual	Potential	GAP
France	40.13	502.71	-462.58	Ireland	0.25	5.37	-5.12
Italy	45.69	256.80	-211.11	Netherlands	21.42	24.96	-3.54
Germany	19.21	171.51	-152.30	Croatia	0.45	3.57	-3.12
Austria	1.62	77.00	-75.38	Romania	0.11	2.14	-2.03
Spain	16.40	61.67	-45.27	Cyprus	1.56	3.40	-1.85
Sweden	1.89	30.49	-28.60	Lithuania	0.13	1.57	-1.44
Greece	4.63	32.40	-27.77	Hungary	0.08	0.88	-0.80
Denmark	3.41	30.75	-27.33	Malta	0.31	1.05	-0.73
Portugal	6.50	33.40	-26.90	Slovakia	0.02	0.54	-0.52
Poland	2.52	18.22	-15.69	Bulgaria	0.06	0.50	-0.44
Belgium	23.26	35.73	-12.48	Slovenia	0.25	0.62	-0.37
Czech Republic	1.12	13.41	-12.29	Estonia	0.11	0.20	-0.10
Finland	0.62	6.35	-5.73				

The export efficiency of Indonesia in the European Union (EU) market during the period of 2003–2021 averaged at 20.93%, which is relatively low compared to global benchmarks in similar studies. For instance, a study conducted by Baniya et al. (2020) on China's Belt and Road Initiative revealed that China's trade efficiency in key European markets often surpassed 60%. This highlights Indonesia's inefficiency in its main export commodities within the EU. Therefore, it is critical for Indonesia to improve its export efficiency to enhance its market niche. Notably, five countries demonstrated relatively high export efficiency scores: the Netherlands (85.83%), Belgium (65.09%), Estonia (52.71%), Cyprus (45.69%), and Slovenia (40.76%). These countries are key access points for Indonesian exports within the EU, aligning with the findings of Ravishankar and Stack (2014), who emphasize the importance of

targeting highly efficient markets to optimize trade potential. Conversely, the countries with the lowest efficiency scores are Sweden (6.20%), Romania (4.99%), Ireland (4.66%), Slovakia (3.42%), and Austria (2.10%). Kalirajan and Bhattacharya (2008) also came to similar conclusions, stating that inefficiencies in certain markets can be attributed to tariff barriers and infrastructural limitations.

The evaluation of the export potential of Indonesian fisheries in the EU market is presented in Table 4, using Equation 11 to obtain the corresponding values. Among the EU countries, France, Italy, Germany, Austria, and Spain show the largest discrepancies between the actual and potential exports of Indonesian fishery products. This observation aligns with Jiang et al. (2022c), who have noted that the presence of a significant export gap indicates untapped trade potential that can be harnessed through targeted trade facilitation measures. The underutilization of Indonesia's fisheries trade in the EU is reminiscent of the inefficiencies in China's exports to emerging markets identified by Tan and Zhou (2015) and highlights the need for a strategic approach. This finding emphasizes the need for Indonesia to focus on key EU markets to enhance efficiency and optimize the use of existing trade potential, ultimately maximizing fishery exports.

Conclusion

This study estimated the factors affecting exports of Indonesian fishery products to the EU market using the SFGM and the MLE, estimated the efficiency value of Indonesian fishery product exports to the EU market, and analyzed the export potential of Indonesian fishery products to the EU market in the 2003–2021 period. The model suitability test was carried out in two stages. First, the value of the gamma coefficient close to 1 (0.86) meant a random share of production, which was explained by the effect of inefficiency or the difference in technical efficiency. Second, a statistically significant value of σ_{α}^{2} indicated that the model had fulfilled the due diligence test. The estimation results showed that the GDP of the exporting country, the GDP of the importing country, competitiveness (RSCA) and the exchange rate of the rupiah against the US dollar had a positive effect on the exports of fishery products to the EU market. On the other hand, the distance proxied using trade costs showed a negative effect on Indonesia's fishery exports to the EU market. In addition, we did not have sufficient evidence to show the effect of the consumer price index on Indonesia's fisheries exports.

Indonesia's average export efficiency in the EU market was 20.93% in the 2003–2021 period, reflecting substantial underperformance relative to its potential. This inefficiency stems from several factors, including structural weaknesses in Indonesia's trade infrastructure, such as inadequate port facilities, inefficient customs processes, and logistical barriers that increase costs and reduce competitiveness. Additionally, Indonesia's export portfolio is focused on low-value, labor-intensive goods, limiting

its ability to compete in the higher-value EU markets. Trade policy misalignments, including high tariffs and non-tariff barriers in key EU markets, further exacerbate these inefficiencies, hindering Indonesia's ability to leverage its comparative advantages, particularly in fisheries.

Indonesia must modernize its trade infrastructure, including ports and transportation networks, to lower trade costs and enhance the reliability of exports. Streamlining customs and regulatory processes is also vital for improving export efficiency. Diversifying the export base by moving up the value chain and investing in higher-value-added goods demanded in the EU is essential. This can be achieved by promoting innovation and technology adoption in key sectors like fisheries and manufacturing. Additionally, the government should negotiate more favorable trade agreements with the EU to reduce tariffs and other trade barriers. Targeted support should be provided to high-potential but currently inefficient industries, such as fisheries, to bridge the gap between actual and potential export performance.

This study offers useful information regarding the factors that influence the Indonesian fishery industry exports to the EU. However, it has limitations due to its reliance on data from 2003 to 2021, which may not fully represent the consequences of more recent global economic changes. Additionally, the research is confined to the EU market, and the outcomes might not be applicable to other regions. Future investigations could extend the time frame to encompass more recent data and explore additional significant export markets, such as the United States or East Asia. Furthermore, a more in-depth, product-specific analysis within the fisheries sector and the integration of qualitative approaches, such as interviews with industry stakeholders, could offer a more refined comprehension of the difficulties and opportunities encountered by Indonesian exporters.

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POVEĆANJE EFIKASNOSTI I POTENCIJALA IZVOZA INDONEŽANSKIH RIBARSKIH PROIZVODA NA TRŽIŠTE EVROPSKE UNIJE

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R e z i m e

Očekuje se da će sporazum o slobodnoj trgovini (engl. *free trade agreement* – FTA) između Indonezije i EU podstaći ekonomski rast Indonezije, posebno u oblasti trgovine. Međutim, od 2020. do 2022. godine, zemlje EU su izdale 38 dopisa u vezi sa izvozom iz Indonezije, pre svega u vezi sa sanitarnim i fitosanitarnim merama, koje predstavljaju necarinske barijere u slobodnoj trgovini. Indonezija nije imala koristi od povećanja uvoza ribarskih proizvoda u EU. Ova studija se bavi nedostacima u istraživanju efikasnosti i izvoznog potencijala ribarskih proizvoda iz Indonezije na tržište EU. Cilj je da se procene faktori koji utiču na tok trgovine, efikasnost izvoza i potencijal izvoza indonežanskih ribarskih proizvoda u EU koristeći stohastički granični gravitacioni model (engl. *stochastic frontier gravity model – SFGM*). Stohastički granični gravitacioni model u gravitacionom modelu određuje maksimalni potencijalni obim razmene koji se može postići u bilateralnoj trgovini. U ovom istraživanju su korišćeni panel podaci o indonežanskom izvozu ribarskih proizvoda u 27 zemalja članica EU od 2003. do 2021. godine (19 godina). U ovoj studiji analizirani su proizvodi HS klasifikacije 03 ribe, ljuskari, mekušci i ostali vodeni beskičmenjaci koji su izvezeni iz Indonezije u 25 zemalja EU. Rezultati su pokazali da su BDP i zemalja izvoznica i zemalja uvoznica, konkurentnost i kurs rupije u odnosu na američki dolar pozitivno uticali na izvoz ribarskih proizvoda u EU. Nasuprot tome, udaljenost, predstavljena troškovima razmene, negativno je uticala na izvoz ribarskih proizvoda iz Indonezije u EU. Rezultati su pokazali da Indonezija nije ostvarila efiksnost na nivou od 100%. Najveći tržišni potencijal Indonezije u EU ogledao se u izvozu ribarskih proizvoda u Francusku, Italiju, Nemačku, Austriju i Španiju.

Ključne reči: izvoz, Evropska unija, ribarstvo, Indonezija, spoljnotrgovinska efikasnost, trgovinski potencijal.

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