Wati, L. A. (2023). Determinants of Indonesia's shrimp commodity export. *Journal of International Studies, 16*(1), 112-127. doi:10.14254/2071-8330.2023/16-1/8

Journal of International Studies

Centre of Sociological Research

Scientific Papers

Determinants of Indonesia's shrimp commodity export

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Abstract. For the last decade, Indonesia has exhibited enormous fishery potential, especially in shrimp commodities, in terms of quantity, export value, and annual production. In Indonesia, shrimp is the commodity with the highest number of transactions compared to other fishery commodities. This research on the factors of Indonesian shrimp exports can be used as a reference and provide more detailed information useful for the government and Indonesian shrimp exporters. Panel data regression analysis and the gravity model were used to obtain the best REM model using GLS. Research results indicated that the GDP per capita of the importing country, distance, and the population of the importing country significantly influenced the export value of Indonesian shrimp. At the same time, the exchange rate was an insignificant variable. Therefore, to increase Indonesia's shrimp export potential, the government and Indonesian shrimp exporters must consider to the importing country's GDP per capita and the selection of partner countries.

Received: June, 2022
1st Revision: October, 2022
Accepted: February, 2023

DOI: 10.14254/2071-8330.2023/16-1/8

Keywords: export value, shrimp, random effect model, Indonesia

JEL Classification: B27, C69, L15, Q02, O53

1. INTRODUCTION

The potential fish resources in Indonesian waters amount to 9.931 million tonnes per year, with the highest potential found in WPP 718 (Arafura Sea) - 1.992 million tonnes/year (20%), in WPP 572 (Indian Ocean west of Sumatra and the Sunda Strait) - 1.228 million/year (12%), and WPP 711 (Karimata Strait, Natuna Sea, and South China Sea) - 1.143 million tonnes/year (12%) (Suman et al., 2016). Presently, Indonesian small-scale fishers are exempted from capture fisheries management measures, as they need not apply for a fishing license, their fishing vessels are not subject to monitoring system requirements, nor must they pay fisheries fees (Halim et al., 2020).

As the largest archipelago country with a manageable marine area of 5,800,000 km², the ocean (maritime) sector is of key strategic importance for Indonesia. Indonesia's status as an archipelagic country

was established by the Djuanda Declaration in 1957 and strengthened by UNCLOS (the United Nations Convention on the Law of the Sea) (Macknight, 1980; van Rossum, 2022; Yoyon Mulyana Darusman, 2020). Indonesia has about 17,500 islands with a coastline of 81,000 km. Approximately 62% of Indonesia's territory is sea and water; the Marine and Fisheries Ministry's data confirm: the land area is 1.91 million km^2, while the water area reaches 6.32 million km^2. Potentially, Indonesian fisheries are the largest in the world, both capture fisheries, and aquaculture (Hall, 2017; Wiraputra et al., 2022). Based on the modus operandi or production method, fisheries are divided into capture fisheries and aquaculture, with a sustainable production potential of around 67 million tons/year. Indonesia, known as "giant archipelago country" in the world community, has a marine territory of around 3.25 million km^2, including 2.55 million km^2 of Exclusive Economic Zones. Therefore, given its ocean area, Indonesia has enormous marine and fishery resource potential.

Based on data from Statistic-KKP (2022), shrimp is the commodity with the highest number of transactions in Indonesia, when compared to other fishery commodities. In 2021, Indonesian shrimp had a total trade value of USD 2,228,947,835 and a total quantity of 50,715,434 kg. According to Wati (2018), shrimp from Indonesia is in high demand in both domestic and international markets.

Indonesia's significant potential for shrimp exports plays a vital role in the long-term development of the Indonesian economy, particularly in boosting the export value of Indonesia's superior products in the global market. According to Government Regulation (PP) Number 41 of 2021 concerning the Implementation of Free Trade Areas and Free Ports (2021), export refers to the act of removing goods from the customs area, which includes land, waters, airspace above it, and specific places in the EEZ and continental shelf, while complying with the applicable terms and regulations.

In 2021, Indonesia's shrimp export trade increased by 0.92% compared to the previous year, according to WorldBank (2022). Research conducted by M. A. Khan et al. (2022), reveals that India was the world's largest shrimp exporter in 2020, followed by Ecuador and Vietnam. Asia accounted approximately 55% of the world's total shrimp exports, with India, Vietnam, Indonesia, Thailand, Bangladesh, and China, being the top six shrimp exporters in the region, responsible for nearly 92% of all shrimp exports.

The Indonesian government aims to reach a shrimp production of 2 million tons, including Vannamei shrimp, by 2024, a portion of which will be for export. To achieve this target, the Directorate General of Aquaculture and the Ministry of Maritime Affairs and Fisheries are implementing a breakthrough program to enhance shrimp farming productivity. To attain this goal, the government must provide support in various aspects, including utilizing digital technology and understanding the factors that influence Indonesian shrimp trading activities.

International trade is the key driver of economic development, aimed at expanding markets and increasing income in the form of foreign exchange. This, in turn, helps to meet domestic needs for both consumption and production, leading to added value (Değer et al., 2019; Deng et al., 2021; Mani et al., 2019). The importance of goods export trade lies in its potential to increase a country's income, and to expand production markets through trade, thereby raising awareness of domestic products in various countries. Such as, trade is positively associated with growth performance (S. A. R. Khan et al., 2019, 2020), making export activities essential for companies, industries, and the competitiveness of each production sector in the global market.

Given the immense potential of Indonesia's fishery sector, trade in the country's shrimp commodity sector can be a key driver for the development of the Indonesian economy. Numerous factors influence the success of shrimp trade, and it is important for researcher to analyze these factors to understand their impact on the industry. **This analysis can provide valuable insights for the government and Indonesian shrimp exporters, helping them to optimize trade outcomes**.

Indonesia holds an important position in the international market for shrimp exports, however, the country still faces limitations in its implementation. Therefore, it is important to analyze the factors that influence Indonesian shrimp trade. Many factors can impact the success of trading, either positively or negatively. Given these challenges, the main research question is **"What is the influence of independent variables on shrimps export from Indonesia?"**. Through an analysis of the factors that influence the Indonesian shrimp trade, researcher can provide valuable insights for international trade.

2. LITERATURE REVIEW

2.1. Previous research

The results of the research conducted by Rindayati & Akbar (2022) provide an estimation of the panel data regression. In their study found that real GDP per capita of the destination countries, economic distance, export prices, real exchange rates, population growth, and the Logistic Performance Index of both Indonesia and destination countries significantly influence Indonesia's frozen shrimp exports to non-traditional markets.

Fitriani et al. (2019) found that competitiveness, logistical performance, population, and exchange rate significantly positively affect the number of frozen shrimp exports, while economic distance, population, exchange rates, and free trade agreements significantly affect fresh shrimp exports.

According to Muryani et al. (2019) findings, there is a negative correlation between shrimp commodity exports and the country's GDP per capita and distance variables. Conversely, there is a positive correlation between shrimp commodity exports and the importing countries' GDP per capita, export prices, and population.

2.2. Theoretical

2.2.1. Comparative advantage theory

The book "Principles of Political Economy and Taxation" by David Ricardo presents the law of comparative advantage. According to the principle of comparative advantage, if a country is more efficient or has an absolute advantage in producing one commodity compared to other countries but is less efficient or experiences total loss in producing the second commodity, it should focus on producing the commodity in which it has comparative advantage, then the two countries can benefit by specializing in the production of each commodity of their absolute advantage and exchanging a portion of their output with other countries for commodities that do not benefit them absolutely (Ricardo, 1821; Salvatore, 2019).

Ricardo, D based his law of comparative advantage on several simple assumptions, namely (1) there are only two countries and two commodities, (2) free trade, (3) labor mobility is perfect within each country but immobility between the two countries, (4) production costs are constant, (5) there are no transportation costs, (6) there are no technical changes, and (7) the labor theory of value (Salvatore, 2019).

2.2.2. Heckscher-Ohlin theory

Heckscher-Ohlin theory, formulated by Eli Heckscher and Bertil Ohlin, posits that a country will export goods that use intensively its abundant factors of production (Salvatore, 2019). A country may have more or less of these factors than other countries, leading to a comparative advantage in a particular production sector, particularly in sectors that require more production factors that are available in relatively large quantities (Costinot, 2009; Deardorff, 2005; Hoen & Oosterhaven, 2006). Essentially, the theory

suggests that a country tends to export goods that use more of its abundant factors of production. A country that is abundant in a factor of production will export commodities that use the factors of production that the country lacks intensively. This trading pattern applies to the case of Indonesia and developed countries with abundant capital.

2.2.3. Export value

Export value refers to the transaction value of goods being exported, which is determined at the loading port of the ship in a free-on-board (f.o.b) condition (Hardman et al., 2002; Tu & Giang, 2018). It includes the total monetary value of the goods being exported, as well as any fees required or expected to be paid by the exporter, such as Value Added Goods and Services Tax and Sales Tax on Luxury Goods (Value Added Goods and Services Tax and Sales Tax on Luxury Goods, 2009).

2.2.4. Currency exchange rate

The exchange rate is the price of one country's currency relative to another country's currency. As a result, the exchange rate affects the relative cost of foreign and domestic goods, services, and financial assets for a country. Development policies should focus on the real economy rather than monetary variables such as the exchange rate (Edwards, 1989; Williamson, 2009). Any change in the exchange rate in the currency of denomination of a contract will immediately result in transaction exchange rate risk for the country or firm involved (Papaioannou, 2006).

2.2.5. GDP per capita

Gross domestic product (GDP) per capita measures a country's economic output per person and is calculated by dividing a country's GDP by its population (Awan & Azam, 2022). GDP per capita is a global indicator of a country's prosperity, and economists use this formula to measure a country's economic growth. Economic growth is determined by an increase in output as measured by GDP per capita (Annis Syahzuni, 2018; Boulhol et al., 2008; Garba & Bellingham, 2021).

2.2.6. Distances

Broadband technology has made trade patterns more sensitive to economic size and distance. Technological adaptation has resulted in demand becoming more elastic to the costs of bilateral trade, thereby indirectly increasing the magnitude of the trade elasticity of distance (Akerman et al., 2022; Kirschbaum-Behl, 2021). The mutual trade relationship between East Asian countries was studied using variables such as population, geographical distance, GDP, and technological distance with the help of the gravity model. The study found that mutual trade has an inverse relationship with technological distance and geographical distance (Emikönel, 2022; Tadesse & Abafita, 2021).

2.2.7 Population

The word "inhabitants" refers to all the people living in a particular place. In the context of an ecosystem, population refers to all the individuals of the same species occupying a certain area. The human population is the number of individuals or groups occupying a particular territory or country for at least one year at the time of data collection or population census (Bergström et al., 2021; Plowright et al., 2021; Wang et al., 2021).

3. DATA AND METHODOLOGY

3.1. Data description

This research uses panel data and time series data from 2012 to 2021, as well as a cross-section consisting of five destination countries: Canada, China, Japan, Malaysia, and the USA. The choice of this period is due to data availability, and the selection of these countries is based on the fact that they imported the most Indonesian shrimp in 2021 (UNComtrade, 2022). The main data was obtained from various sources, including UN Comtrade, UNCTAD, Worldbank, and CEPII. The specific source of each data is tabulated in Table 1.

Table 1

Research data

No	Data	Source
1	Export value of Indonesia's shrimp **Commodity code:** 030617, 030636, 160521	UN Comtrade
2	Exchange rate	UNCTAD
3	GDP per capita of partner countries	Worldbank
4	Distances	CEPII
5	The population of partner countries	Worldbank

Source: own compilation

3.2. Research method

This study uses the Gravity Model, which was originally introduced by Jan Tinbergen. The idea that underpins the gravity model is rooted in Newton's law of gravity, which asserts that the trade between two economies is impacted by their respective masses and the distance between them. The gravity model has been applied to various international trade cases, where the value of export trade from country *i* to country *j* is related to the "economic mass" (measured using the country's GDP) and the distance described using the duration of shipment from the main port of the exporting country to the importing country (Agus Sapari, 2019).

To achieve the research objectives regarding the factors that can affect the value of Indonesia's shrimp exports in the 2012-2021 period, various testing stages were initially conducted, including the heteroskedasticity and autocorrelation tests, to determine if there is a correlation between each independent variable. This was followed by the Hausman test to determine the best estimation method for the research. The results of the Hausman test showed that the Random Effects Model (REM) test using the semi-log method was an appropriate estimation method. The application of the REM test uses the semi-log method, where the dependent variable does not use logs and applies the natural logarithm to each independent variable.

Prior to discussing the assumptions of the random effect model and their significance when violated, the semi-log application is used to obtain statistical significance results for each independent variable (Bell et al., 2019; Wooldridge, 2019). Table 2 provides a summary of the dependent and independent variables used in this study.

Table 2

Summary statistics

Variable	Obs	Mean	Std. dev.	Min	Max
lnexp_val	122	15.93362	3.04015	7.629004	20.83517
lnexc_rate	122	9.473579	0.134169	9.147041	9.587557
lnim_GDPc	122	10.17099	0.802397	8.748403	11.14602
lndist	122	8.716533	0.91278	7.175211	9.650907
lnim_pop	122	18.77087	1.404213	17.18516	21.06853

Source: own calculation

This research uses Indonesia's shrimp export value as the dependent variable. The independent variables used are the exchange rate, GDP per capita of importer countries, distances, population of importer countries, and the export price of Indonesia's shrimp.

The model used is formulated as follows:

$$lnexp\_val_{jth} = \alpha_0 + \alpha_1\, lnexc\_rate_{it} + \alpha_2\, lnim\_GDPc_{jt} + \alpha_3\, lndist_{ij} + \alpha_4\, lnim\_pop_{jt} + \varepsilon_{jth}$$

Where:

i : exporter country (Indonesia)

j : importer countries (Canada, China, Japan, Malaysia, and the USA)

t : time

h : HS code commodity (030617, 030636, 160521)

u : component cross-section error

v : time series error component

w : combination error component

ε : error term (the amount by which the equations may differ during empirical analysis) (ε = u + v+ w)

α_0 : coefficient of the dependent variable

$\alpha_1 - \alpha_4$: coefficients of independent variables

exp_val_{jth} : Value of shrimp exports from Indonesia to importer countries in year t (in each product)

exc_rate_{it} : Rupiah exchange rate against USD in year t

im_GDPc_{jt} : GDP per capita of importing country in year t

$dist_{ij}$: Distance from Indonesia to export destination country

im_pop_{jt} : Population of each importing country in year t

3.3. Object of research

This research examines the impact of four independent variables - exchange rate, GDP per capita, distances, and population of importer countries - on the export value of Indonesia's shrimp. The data used in this research is panel data with three dimensions: time (from 2021 to 2021), importer countries (Canada, China, Japan, Malaysia, and the USA), and commodity codes (030617, 030636, 160521).

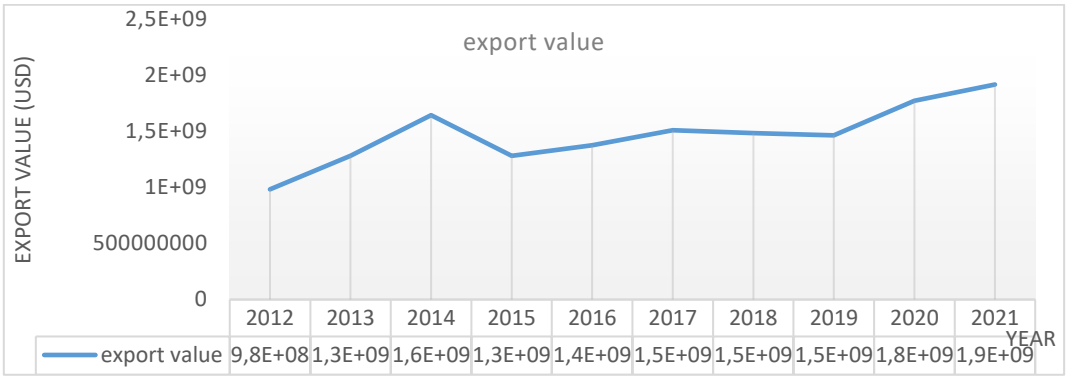

Figure 1. Export Value of Indonesian Shrimp Export, 2012-2021
Source: UN Comtrade; Authors' calculations

Export value of Indonesia's shrimp: The shrimp export value of Indonesia from 2012 to 2021 is the dependent variable in this study. The main data used in this study are the export values of Indonesian shrimp to Canada, China, Japan, Malaysia, and the USA. HS codes 030617, 030636, and 160521 were sourced from UN Comtrade. The data in Figure 1 shows the export value of Indonesian shrimp in USD.

Exchange rate: The exchange rate variable used in this study is the IDR to USD exchange rate. We use this exchange rate to examine the relationship between the IDR to USD exchange rate and the value of shrimp exports from Indonesia to Canada, China, Japan, Malaysia, and the USA, as shown in Figure 2.

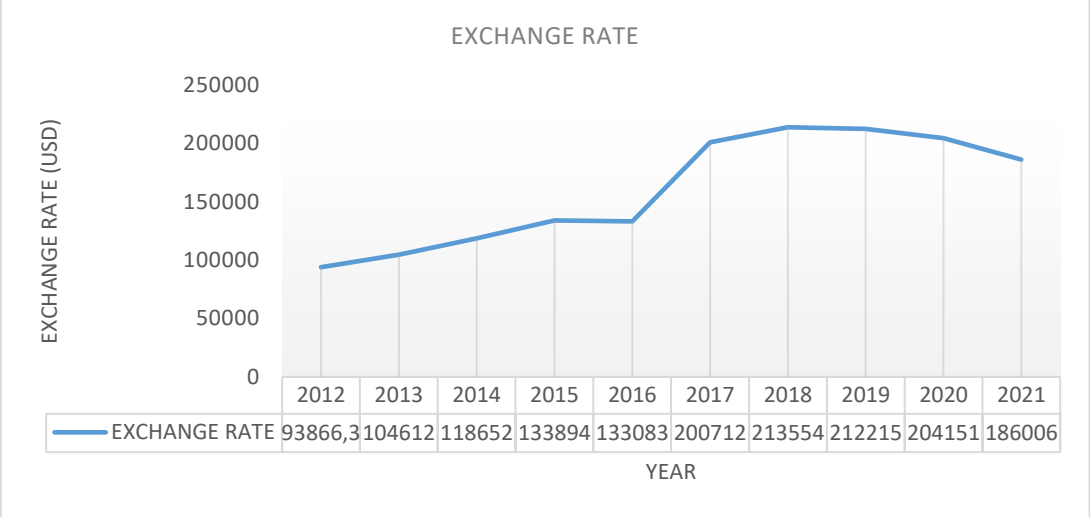

Figure 2. Development of the IDR Exchange Rate against the USD in 2012-2021
Source: UNCTAD; Authors' calculations

GDP per capita of importer countries: The researcher used the GDP per capita of the importing countries in US dollars from 2012 to 2021 to explain the influence of these countries on the total value of Indonesian shrimp exports. The importer's GDP variable was applied to determine the impact of the GDP level of each importing country on the value of the dependent variable, as depicted in Figure 3.

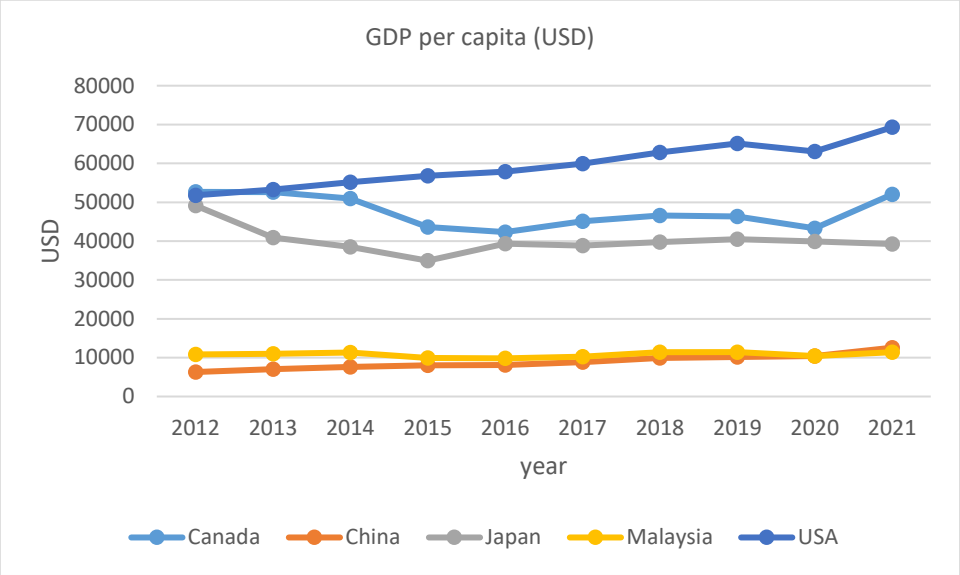

Figure 3.Development of GDP per Capita of Importing Countries, 2012-2022
Source: Worldbank; Authors' calculations

Distance: CEPII has calculated and provided various measures of bilateral distances (in kilometers) for most countries globally (Mayer & Zignago, 2006). This study utilizes data from Indonesia as an exporter to Canada, China, Japan, Malaysia, and the USA as importing countries, as shown in Figure 4.

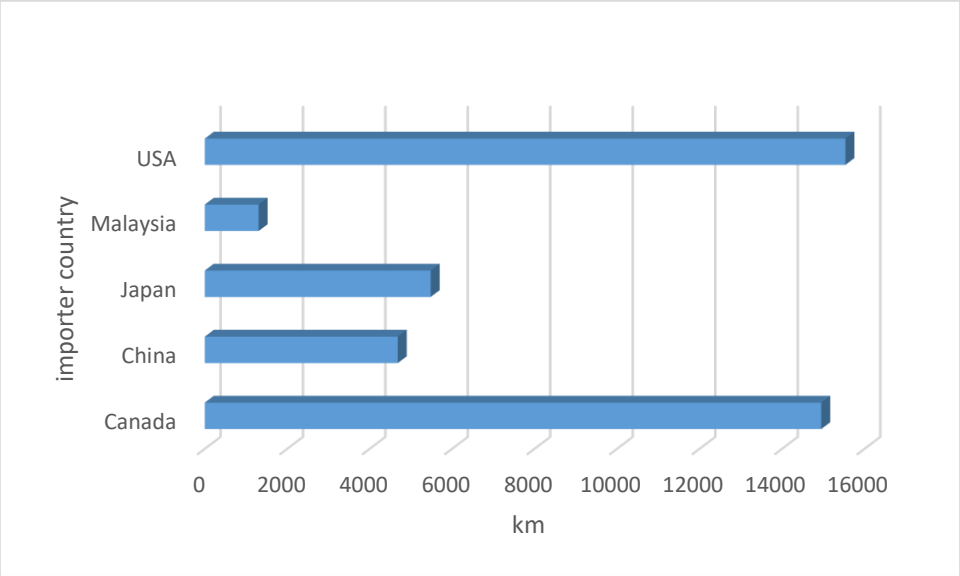

Figure 4. The Distance between Indonesia and the Five Destination Countries
Source: CEPII; Authors' calculations

The population of importer countries: The population size of each Indonesian shrimp importing country is represented by the population variable in this study. The population variable will be tested against the value of Indonesian shrimp exports from 2012 to 2021 to examine the impact of each country's population growth on the dependent variable. The results are graphically depicted in Figure 5.

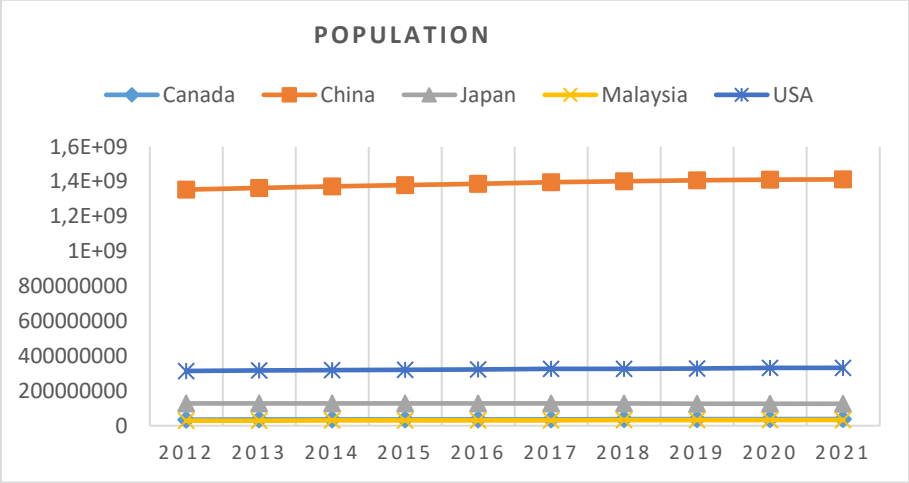

Figure 5. The population of Destination Countries, 2012-2021

Source: Worldbank; Authors' calculations

3.4. Research hypothesis

The expected results of this study are based on the effects of the independent variables on the dependent variable, as depicted in the research framework shown in Figure 6.

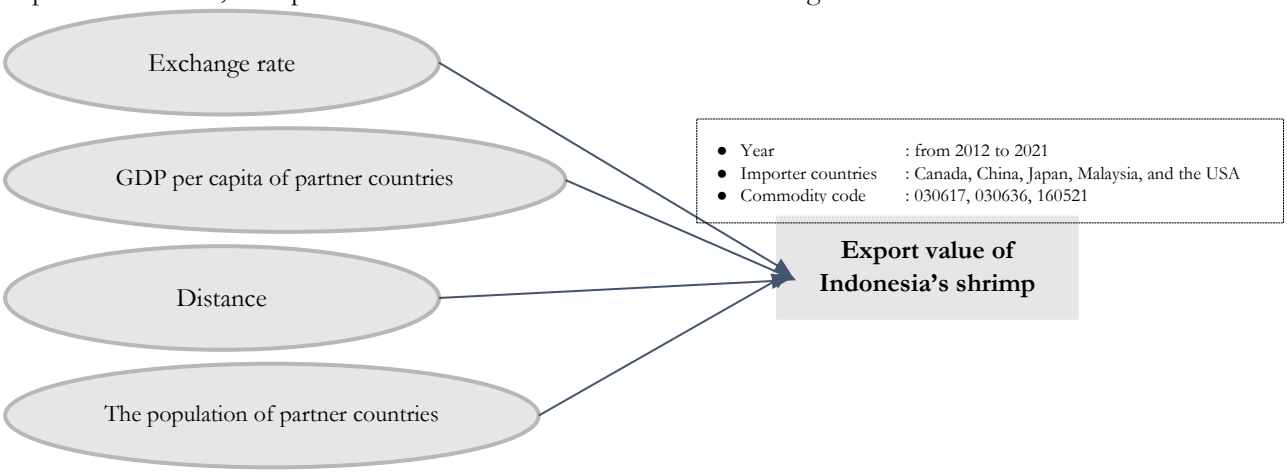

Figure 6. Framework

Exchange rate: The exchange rate is an independent variable that is expected to have a positive impact on the value of Indonesian shrimp exports to the five partner countries. If the Rupiah depreciates, the value of Indonesian shrimp exports is expected to increase annually.

H_0 : A decrease in the exchange rate of the Rupiah towards the USD will lead to an increase in Indonesia's shrimp export trade (positive coefficient)

H_1 : A decrease in the exchange rate of the Rupiah towards the USD will lead to a decrease in Indonesia's shrimp export trade (negative coefficient)

GDP per capita of partner countries: The variable "importers' GDP (per capita)" is used to determine the impact of the GDP level of each importing country on Indonesia's shrimp export trade from 2012 to 2021. It is expected that the variable "importers' GDP (per capita)" will have a positive impact on the export value of Indonesian shrimp to Canada, China, Japan, Malaysia, and the USA. This means that

the higher the GDP per capita of the importing countries, the higher the value of shrimp exported per year from the exporting country.

H_0 : An increase in importers' GDP per capita will result in an increase in shrimp export value (positive coefficient)

H_1 : An increase in importers' GDP per capita will result in a decrease in the value of Indonesian shrimp exports (negative coefficient)

Distance: The distance variable is expected to have a negative impact on Indonesian shrimp exports to Canada, China, Japan, Malaysia, and the USA. This means that the further the distance, the lower the value of Indonesian shrimp exports per year.

H_0 : If the shipping distance to the importing country increases, then the export value of Indonesian shrimp will decrease (negative coefficient)

H_1 : If the shipping distance to the importing country increases, then the value of Indonesian shrimp exports will increase (positive coefficient)

The population of partner countries: The population variable is expected to have a positive impact on Indonesian shrimp exports to Canada, China, Japan, Malaysia, and the USA. It means that the higher the population of the importing country, the higher the value of Indonesian shrimp exports per year.

H_0 : An increase in the population of the importing country will lead to an increase in the export value of Indonesian shrimp (positive coefficient)

H_1 : An increase in the population of the importing country will lead to a decrease in the value of Indonesian shrimp exports (negative coefficient)

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. The best model of panel data

A Chow test was conducted in panel data to determine whether the PLS model or FEM was better. The hypotheses for the Chow test were H_0: PLS and H_1: FE. We will reject H_0 if the P value < α. The Chow test showed that the P value was 0.0000, indicating that P value < α. Therefore, we reject H_0: PLS and accept H_1: FE. Since the FE model is the best model according to this test, we will proceed to perform the Hausman test.

```
F( 13,   104) =   43.05
     Prob > F =    0.0000
```

Table 3

Hausman test

```
. hausman fe re
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) Std. err.
lnexc_rate	-.007043	-.2424182	.2353752	.722848
lnim_GDPc	.7595373	1.267261	-.507724	.4920827
lnim_pop	.3727245	.8429484	-.4702239	6.103657

```
                b = Consistent under H0 and Ha; obtained from xtreg.
 B = Inconsistent under Ha, efficient under H0; obtained from xtreg.

Test of H0: Difference in coefficients not systematic

    chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
            =   0.67
Prob > chi2 = 0.8806
(V_b-V_B is not positive definite)
```

Source: own calculation

Furthermore, the researcher will now perform the Hausman test (Table 3) to determine whether the Random Effects Model (REM) or Fixed Effects Model (FEM) is the best model. In the Hausman test, we have H_0: REM and H_1: FEM. We will reject H_0 if the P-value < α. The Hausman test results showed that the P-value was 0.8806, which means that P-value > α. Therefore, we accept H_0: REM and reject H_1: FEM. This test concludes that the Random Effects Model (REM) is the best model for this research.

4.2. The generalized least square regression

Table 4

GLS regression

```
Cross-sectional time-series FGLS regression

Coefficients:  generalized least squares
Panels:        heteroskedastic
Correlation:   common AR(1) coefficient for all panels  (0.9025)

Estimated covariances      =        15          Number of obs     =         122
Estimated autocorrelations =         1          Number of groups  =          15
Estimated coefficients     =         5          Obs per group:
                                                               min =           5
                                                               avg =   8.133333
                                                               max =          10
                                                Wald chi2(4)      =      117.95
                                                Prob > chi2       =      0.0000
```

lnexp_val	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
lnexc_rate	1.075652	.4537387	2.37	0.018	.1863402	1.964963
lnim_GDPc	2.318777	.4070717	5.70	0.000	1.520931	3.116622
lndist	-.9256862	.3681639	-2.51	0.012	-1.647274	-.2040983
lnim_pop	1.176664	.2248444	5.23	0.000	.7359769	1.617351
_cons	-30.19751	5.930408	-5.09	0.000	-41.8209	-18.57413

```
. estimate store het_ar1
```

Source: own calculation

$$lnexp\_val_{jth} = -30.19751 + 1.075652\ lnexc_{rate_{it}} + 2.318777\ lnim_{GDPc_{jt}} - 0.9256862\ \ lndist_{ij} + 1.176664\ lnim\_pop_{jt} + \varepsilon_{jth}$$

The best model for this study is the random effect model using the semi-log method. The empirical results, as presented in Table 4, explain the effect of each independent variable on the dependent variable. Additionally, Table 5 displays the significance level of each variable.

Table 5

Statistically significant level

```
. esttab het_ar1, star stats (N)

──────────────────────────────
                      (1)
                  lnexp_val
──────────────────────────────
lnexc_rate          1.076*
                   (2.37)

lnim_GDPc           2.319***
                   (5.70)

lndist             -0.926*
                  (-2.51)

lnim_pop            1.177***
                   (5.23)

_cons              -30.20***
                  (-5.09)
──────────────────────────────
N                     122
──────────────────────────────
t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001
```

Source: own calculation

The exchange rate elasticity of export volumes is a critical element in macroeconomics. The proportion of intermediate exports used to produce goods that are further exported to a third currency zone by the trading partner makes bilateral trade flows sensitive to the trading partner's exchange rate (Alessandria & Choi, 2021; N. Chen et al., 2022; de Soyres et al., 2021). The coefficient of the exchange rate variable is 1.075652, indicating its significant effect. As it has a positive coefficient, the null hypothesis (H_0) is accepted. This variable shows a significance level of α=0.05. The exchange rate exhibits a positive coefficient, indicating that a depreciation of the Rupiah exchange rate against the USD results in an increase of 1.075652% in the value of Indonesian shrimp exports. This result suggests that a weaker Rupiah reduces the price of goods denominated in USD, making them cheaper, and thus, increasing the buying power of imports.

The coefficient of the independent variable GDP per capita of the importer countries is 2.318777, indicating that H_0 is accepted. This variable shows a significance level of α=0.001. The results of the study support the research hypothesis. Real GDP per capita represents the level of consumption in the destination country, which affects trade. A higher real GDP per capita indicates increasing consumption, which requires trade to meet the demand. Indonesian shrimp exports can fulfill the needs of the destination country by trading with Indonesia. This result encourages Indonesia to increase trade by boosting the volume/export value of Indonesian shrimp. The model estimation findings indicate that the destination country's real GDP per capita benefits the export value of Indonesian shrimp. The five countries to which Indonesia exports shrimp are Canada, China, Japan, Malaysia, and the USA. The probability of the destination country's real GDP per capita is 0.0000, lower than the significance level of 1%. The findings suggests that the effect is positive and statistically significant. This result implies that an increase of 1 USD in the destination country's real per capita income will increase the export value of Indonesian shrimp by 2.318777 USD, ceteris paribus.

The third independent variable in this research is the distance variable. The coefficient of the distance variable is -0.9256862, indicating that H_0 is accepted. This variable shows a significance of α=0.05. The model indicates that economic distance has a negative effect on the export value of Indonesian shrimp, which is significant with a probability value of 0.0000 at a significance level of 0.05. Economic distance

refers to the transportation costs paid by the two trading parties. The coefficient of economic distance is -0.9256862 and has a negative effect on the export value of Indonesian shrimp, meaning that every increase in economic distance by 1 USD/km will reduce the export value of Indonesian shrimp by 0.9256862 USD, ceteris paribus. Economic distance represents the cost that trade activity must bear due to trade between two countries separated by increasingly distant geographical distances. The results of this study support the hypothesis used, as the gravity model suggests that distance will have a negative effect because the higher the distance, the higher the transportation costs. These high costs will reduce Indonesia's shrimp export volume in international markets.

The gross domestic product (GDP) of the importer significantly and positively affects Indonesia's export intensity, while the exporter's GDP and economic distance have a significant negative effect (Li et al., 2021; Stievany & Jalunggono, 2022; Triyawan et al., 2010). The Indonesian government needs to improve necessary infrastructures, such as network shipment or delivery, packaging, and transportation, to address this issue (Rosyadi et al., 2021; Wati et al., 2013).

Population is one of the factors influencing imports (M. Chen & Wang, 2022; Mwangi, 2021). The coefficient of the population of importer countries, the last independent variable, is 1.176664, indicating that H_0 is accepted. This variable shows the significance of α=0.001. The population variable has a positive coefficient, indicating that the higher the population (absorption effect) of the importing country, the relative value of Indonesian shrimp exports can increase by 1.176664%. This finding suggests that as the population of the importing country increases, the demand for Indonesian shrimp also increases.

The results of this study are consistent with previous research. A 10% increase or decrease in GDP per capita has a minimal impact on shrimp export competitiveness in the short term. Additionally, the economic distance and exchange rate variables significantly affect the export of fresh shrimp at α=1%. The population variable shows a positive coefficient, indicating a relative increase in Indonesian fisheries exports of 5.572585%. This finding suggests that as the population of the importing country increases, the demand for Indonesian fishery products also increases, resulting in an increase in export value (Fitriani et al., 2019; Hidayati et al., 2015; M. A. Khan et al., 2022; Le et al., 2022).

5. CONCLUSION

Conclusion - The panel data regression analysis with the gravity model yielded the best REM model using GLS. The results indicate that the variables significantly affecting Indonesia's shrimp exports are the real GDP per capita of the destination country, the real exchange rate of the rupiah against the dollar, and distance. Among these, the real GDP per capita of the importing country is the most significant factor influencing Indonesia's shrimp exports.

Suggestion - Further research should explore a larger sample size of exporters and importers and a broader range of fishery products to validate the impact of these variables and strengthen the statistical significance of the findings.

ACKNOWLEDGEMENT

The author would like to express her gratitude to the Korean Council for University Education (KCUE) for providing the Higher Education for ASEAN Talents (HEAT) scholarship to pursue her Ph.D. studies in the International Trade Department, Kangwon National University, Republic of Korea.

Additionally, the author extends her sincere appreciation to Professor Jihyun Eum (음지현) for her excellent valuable guidance, patience, and feedback throughout the preparation of this paper.

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