# Analysis of Indonesian Shrimp Exports to The United States Trough ECM Approach

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## ABSTRACT

This study aims to analyze the effect of Indonesian shrimp production, the population of the United States, the gross domestic product of the United States, working capital loan interest rates, US dollar exchange rates (Rp), and export shrimp prices on the volume of Indonesian shrimp exports to the United States for the period 1989-2021. This study uses time series for the period 1989-2021. The analysis used in the study was Error Correction Model with eviews nine software. The test results simultaneously showed a joint influence between production, US population, US GDP, working capital loan interest rates, US dollar exchange rates (Rp), and export shrimp prices on Indonesian shrimp exports. Partial results showed that the production of Indonesian shrimp and US GDP positively and significantly affected the volume of Indonesian shrimp exports to the United States in the short and long term. The population has had a negative and significant effect for a long time, but not by the hypothesis. In contrast, in the short term, the population has no significant impact on shrimp exports. Interest rates on working capital loans, the exchange rate of the US dollar against the rupiah, and the price of shrimp exports do not significantly affect the volume of Indonesian shrimp exports to the United States in the long and short term.

**Keywords:** Shrimp; exports; ECM.

## 1. Introduction

Indonesia is an archipelago with vast territorial waters, which is an advantage for Indonesia as one of the world's fisheries producers. Indonesia's abundant fishery commodities encourage international trade. The form of international trade is export activity. Based on the Law of the Republic of Indonesia Number 7 Year 20014 concerning Trade, export removes goods from the customs area. Export activities can occur when a country has abundant natural resources; the purpose of export activities is to meet the needs of a country's population and increase foreign exchange. Shrimp commodity is one of the leading commodities in non-oil and gas exports. Based on data released by FAO (2018), the export value of shrimp ranks first with an export value of 1,345,722,000 USD. Figure 1 shows the world shrimp producers in 2004-2013.
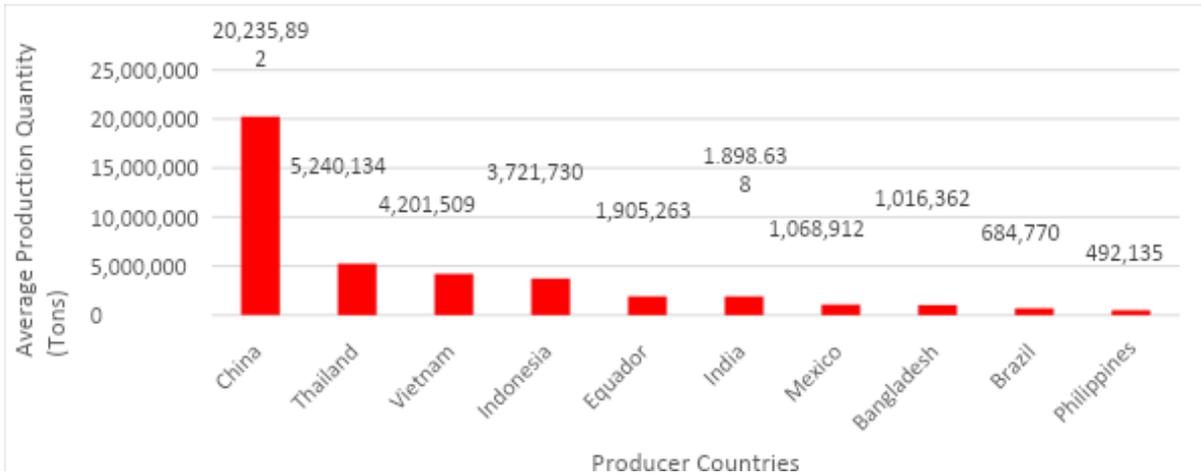
Figure 1 : World Shrimp Producers 2004-2013

Based on data reported by FAOSTAT (in KKP, 2018), shrimp commodity producer countries are spread across several countries, including China, Thailand, Vietnam, Indonesia, Ecuador, and India. The markets for Indonesian shrimp products are the United States, Japan, China, and Europe. Shrimp commodities are among the top ten of primary commodities on Indonesia's non-oil exports commodities, where shrimp ranks eighth.

The primary market for Indonesian shrimp commodities is the United States, where export demand for fish is increasing as a result of changes in red meat consumption, overconsumption of red meat where excessive red meat consumption will result in increased mortality risk and a reduction in one serving of red meat per day by replacing with one serving of fish per day over eight years was associated with a 17% lower risk of death (Zheng et al., 2019). However, the increasing demand for fish exports has not made Indonesia the master of the United States market. US NMFS data reported in 2020) shows that India is the master of the United States market for shrimp commodities while Indonesia is in second place; this is inversely proportional to Indonesia's average production, which is superior to India. Seeing the great potential of Indonesia's vast territorial waters and export demand for shrimp, a comprehensive study is prepared to analyze the determinants of Indonesian shrimp exports to the US from 1989-2021.

## 2. Literature Review

Production is processing existing production factors or inputs to obtain new output results. A commodity's production is determined based on the amount of capital, natural resources, labor, and technology used. According to Gilarso (2004), production is an activity carried out by humans to produce goods and services that have benefits for human life. The more goods produced compared to the total consumption of a country's population, the excess production will be sold by producers to other countries.

According to (Maulana & Kartiasih, 2017), a positive correlation exists between population and the amount of goods consumers demand—the increase in a country's population results in an increase in the quantity of goods purchased. Based on research conducted by Hatab et al. (2010), GDP positively correlates with international trade. Increasing a country's income will increase the country's ability to import.

High and low interest rates affect the attractiveness of the community or business actors as producers to borrow capital. The high-interest rate will affect the number of people who will borrow funds, thus affecting the decline in the production of goods; this will decrease the number of exports and vice versa (Siregar, 2020).

Exchange rates influence international trade transactions, especially in export activities. According to Sukirno (2012), there is a positive correlation between exchange rates and a country's exports. When the condition of the dollar exchange rate rises from the previous state against the rupiah, domestic prices will be cheaper and increase the demand for exports of these goods. Based on the research of Ayuningtyas & Nahar (2013), the results show that there is a negative and significant impact among the price of export and volume of the export. An rises on the price of a good will reduce consumer interest in buying the item so that the total demand for commodities decreases.

## 3. Research Methodology

The quantitative data utilized in this study were obtained from secondary sources., which are data obtained from institutions or data in the form of reports. The type of data used is time series data from 1989-2021 obtained through the BI (Bank Indonesia) website, BPS (Central Bureau of Statistics), One Data Ministry of Trade, UN Comtrade, World Bank, Trade Map, DJPB, DJPT and KKP (Ministry of Marine Affairs and Fisheries) also from the other literature. The analysis method that used in this study is the Error Correction Model, with the help of Eviews 9

software. The ECM model is a better model than other modeling because the ECM model can be used to

find solutions to specific variables that are non-stationary and experience tapered regression in

econometric analysis (Gujarati, 2003). Economically, the model in this study is as follows:

Vol_Export = f (Shrimp, LNTP, GDP, Interest Rate, Exchange Rate, SPExport) (1)
The long run equation uses the following model :
Vol_Export = $\alpha 0$ + $\alpha 1$ Shrimp+ $\alpha 2$ LNTPt + $\alpha 3$ GDPt + $\alpha 4$ Interest Rate + $\alpha 5$ ERt + $\alpha 6$ SPEXSPORTt + e (2)
The model used in the ECM equationuses the following model :
DVol_Export = $\beta 0$ + $\beta 1$ DShrimp+ $\beta 2$ DLNTPt + $\beta 3$ DGDPt + $\beta 4$ Interest Rate + $\beta 5$ DERst + $\beta 6$ DSPEXSPORTt + ECT (-1) + $\mu$t. (3)
The ECT equation used in this study is as follows:
ECT = DShrimpt-1 + D LNTPt-1 + DGDPt-1 + DInterest Rate-1 + DERt-1 + DSPExsportt-1 (4)
    In this study, additional tests to complement and refine the research results, including the classical assumption test, hypothesis testing, and apriori testing.

## 4. Results

*4.1 Unit Root Test*

The test destined to know whether the data used in the study is stationary. If the level shows non-stationary conditions, a further test is carried out with the degree of integration test at the first difference I (1) or second difference I (2) level.

Table 1.  Level and First-Difference Unit Root Test Results

| Variable | Level | *First Difference* |
|---|---|---|
| | Probability | Probability |
| Export Volume | 0.9996 | 0.0001 |
| Shrimp Production | 0.9637 | 0.0001 |
| Total Population US | 0.9836 | 0.0150 |
| GDP US | 0.9999 | 0.0001 |
| Interest Rate | 0.5637 | 0.0000 |
| Excange Rate (US$/Rp) | 0.7509 | 0.0001 |
| Export Shrimp Price | 0.6376 | 0.0131 |

According to the unit root test in the level findings that the independent variables in this study (shrimp production, US population, US GDP, working capital loan interest rates, US dollar to rupiah exchange rates, and export shrimp prices) are non stationary which is indicating that the probability value is higher than the significance level of α 5%. In addition, all variables at the first level of difference  were stationary with a probability value below the significance level of α 5%.

*4.2 Residual Cointegration Test*

The cointegration test detects whether there is a relationship among the variables in the long run. The cointegration test used in this research is the Engle-Granger Cointegration Test.

Table 2. Residual Cointegration Test Results

| Variable | t-statistic | Probability |
|---|---|---|
| ECT | -6.963653 | 0.0000 |

The residual cointegration test results findings that the probability value of the residual (ECT) is less than the significance level of α 5% which is has value of 0.0000. Thus, it concludes that the residuals cointegrate with other variables, with a long-term correlation between variables.

*4.3 Classical Assumption Test*

The Autocorrelation test is intended to detemine whether there is a correlation among the confounders factors of period t and those of the previous period. Durbin-Watson Test used as a autocorrelation test.

Table 3.  Autocorrelation Test Results

| Value | | | | |
|---|---|---|---|---|
| Durbin Watsin statistic | Dl | Du | 4-du | 4-dl |
| 1.993321 | 1.0607 | 1.899 | 2.101 | 2.9393 |

The results show that the DW Statistic value of 1.99 is among the du and 4-du values of 1.899 and 2.101 (du < dw < 4-du), meaning that the regression model avoids autocorrelation problems. The multicollinearity test aims to measure the degree of relationship between the independent variables used in the multicollinearity test is Variance Inflation Factors (VIF) with Centered Variance Inflation Factor values. If the value is smaller than 10, it can conclude that the model has no multicollinearity problems.

Table 4. Multicollinearity Test Results

| Variable | *Centered* VIF |
|---|---|
| D(Shrimp) | 1.492423 |
| D(LnTP) | 1.197717 |
| D(GDP) | 1.747496 |
| D(Interest_Rate) | 1.276866 |
| D(ER) | 1.256664 |
| D(SPekxport) | 1.262341 |
| ECT(-1) | 2.068918 |
| C | NA |

The analysis shows that all variables have a Centered VIF value <10, concluding that all independent variables are free from multicollinearity problems.
The heteroscedasticity test detects whether there is an inequality of variance among the residuals of an observation to the another. Breusch Pagan Godfrey test used in this test.

Table 5. Heteroscedasticity Test Results

| Obs*R-Squared | 9.308171 |
|---|---|
| Prob. Chi-Square(7) | 0.2313 |

The findings reveal that the probability value is 0.2313, which is the probability value is more significant (>) than the significance level of α 5%, implying that there is no heteroscedasticity problem is detected in the model.
Normality test destined to check whether the data distribution is normally distributed. Residuals are normally distributed if the probability greater than significance level of α 5%.

Table 6. Normality Test Results

| Jarque-Bera | 0.351942 |
|---|---|
| Probabilitas | 0.838642 |

The results show that the residuals are normally distributed with the probability value of 0.838642 that is greater (>) than the α 5% of significance level.
The linearity test is intended to check whether there is a linear relationship among the variables. The linearity test used is the Ramsey Reset Test. If the probability value> 5% α significance level, it can be that there is a linear correlation and vice versa.

Table 7. Linearity Test Results

| *F-statistic* | 1.166664 |
|---|---|
| *Probability F-statistic* | 0.2918 |

Based on the results of the data processing findings that the probability value of the F-statistics is 0.2918, which is more significant (>) than the α 5% of significance level.Therefore, the independent variable (shrimp production, US population, US GDP, working capital loan interest rates, US dollar to rupiah exchange rates, and export shrimp prices) shows that there is a linear correlation with the export volume.

*4.4 Short-term and Long-term Regression*

Table 8.  Short-term and Long-term Regression Results

| Variable | Short-term | | Long-term | |
|---|---|---|---|---|
| | Coeff | Prob | Coeff | Prob |
| D(Shrimp) | 28.37048 | 0.0140 | 29.76332 | 0.0061 |
| D(LnTP) | -5.38E+08 | 0.1490 | -3.86E+08 | 0.0000 |
| D(GDP) | 6035366 | 0.0382 | 10601339 | 0.0000 |
| D(Interest_Rate) | -132026.4 | 0.6726 | -258185.2 | 0.4598 |
| D(ER) | 371.3453 | 0.6701 | 752.6837 | 0.3582 |
| D(SPekxport) | 279719.0 | 0.7095 | 581967.8 | 0.3585 |
| ECT(-1) | -0.989811 | 0.0012 | - | - |
| C | 4283048. | 0.3164 | 7.41E+09 | 0.0000 |
| R-squared | 0.555143 | | 0.984348 | |
| F-statistic | 4.100283 | | 262.0391 | |
| Probability (F-statistic) | 0.004658 | | 0.000000 | |

Based on short term results, there are two variables that  have a significant impact on Indonesian shrimp exports to the US , namely shrimp production with a probability value of 0.0140 < 5% and the US GDP variable has a probability value of 0.0382 < 5%. While the other four variables, namely the variable population (0.1490 > 5%), interest rates on working capital loans (0.6726 > 5%), exchange rates (0.6701 > 5%), and export shrimp prices (0.7095 > 5%), does not  have a significant impact to the Indonesian shrimp exports to the US in 1989-2021. The test simultaneously show that all variables considerably has an impact on shrimp exports to the US with the probability value lower than significance level of α 5% which is has value 0.004658. The results from the coefficient determination showed a value of 0.555143, meaning that the independent variables (shrimp production, US population, US GDP, interest rates on working capital loans, exchange rates, and export shrimp prices) were able to explain Indonesian shrimp exports to the US by 55.51%. Other variables explained the remaining 44.49%.

Based on the long term results, it can be concludes that there are three variables which is have a significant impact on the shrimp exports, namely, the Indonesian shrimp production variable with the probability value of 0.0061 < 5% and the population variable has a significant effect but not following the hypothesis where the probability value is 0.0000 and the US GDP variable with a probability value is 0.0000. While the probability value of the working interest rate variables (0.4598 > 5%), the exchange rate (0.3582 > 5%), and the price of shrimp exports in US (0.3585 > 5%) does not have significant impact on Indonesian shrimp exports to the US with a probability value > 5%. Based on the test results of F-test show that all variables have a

significant implications on Indonesian shrimp exports to the US with the probability value is 0.000000 < 5%. Meanwhile, the results of the coefficient determination test showed a value of 0.984348 or 98.43%, meaning that the independent variables (shrimp production, US population, US GDP, working capital loan interest rates, exchange rates, and export shrimp prices) were able to explain Indonesian shrimp exports to the United States by 98.43% and other variables explained the remaining 1.57%.

*4.5 Apriori Test*

The apriori test tests the suitability of the sign between the regression parameter coefficients and the intensity in the economic correlation among the variabeles used in this research include independent variable and dependent variable against the hypothesis formulated based on the theory and relevant previous research.

Table 9. Apriori Test Results

| Variable | Hypothesis | Results | Conclusion |
|---|---|---|---|
| D(Shrimp) | + | + | Retrieved |
| D(LnTP) | + | - | Not suitable |
| D(GDP) | + | + | Retrieved |
| D(Interest_Rate) | - | - | Retrieved |
| D(ER) | + | + | Retrieved |
| D(SPekxport) | - | + | Not suitable |

Based on the results of apriori tests in the short term and long term findings that shrimp production, the US population, interest rates on working capital loans, and exchange rates align with theory. Meanwhile, the variables of the US population and expo rt shrimp prices show a mismatch with the idea.

## 5. Discussion

Based on the results of simultaneous test (F test) on the independent variables (shrimp production, US population, US GDP, working capital loan interest rates, exchange rates (US $ / IDR), and export shrimp prices simultaneously have an impact on Indonesian shrimp exports to the US from 1989-2021.
Indonesia is a world fisheries-producing country; one of the flagship products of the fishing industry is shrimp, which is shrimp has various active compounds that are good for the body. The world community's awareness of shrimp's benefits for the body increases export demand. Production can increase export volumes if the products produced have good quality following those set by the destination country. Based on the data analysis calculations above, shrimp production has a significant and positive impact on Indonesian shrimp exports to the US the probability value in the short term is 0.0140 while in the long term having prbability value of 0.0061. The results of the research which is based on study by Kusumawati et al. (2016) with the tittle of the Impact of Production, Prices, and Exchange Rates on Export Volume (Study on Shrimp Export Volume from Indonesia to Japan Period 2012-2014); the shrimp production variable has a significant impact on the volume of shrimps exports from Indonesian to Japan.
Based on the result of the analysis, it can concludes that the US population in the short term does not have significant impact on Indonesian shrimp exports, with a probability value of 0.1490. On

the contrary, for the long term it showed that has a significant influence among the US population and Indonesian shrimp exports but did not follow the hypothesis. The results showed a mismatch with the existing theory; this study is consistent with the research by Adelina et al. (2020)  with the tittle on the Analysis of the Export Determinants of Indonesian Cocoa with the Gravity Model Approach and research by Yarasevika & Nurmalina (2022) with the tittle on the Determinants of Indonesian RPO Exports in the Islamic Cooperation Organization Market that, the population does not have significant impact on the exports. The insignificance of the population is because total exports tend to fluctuate while the destination population tends to increase yearly.

GDP is the total value that all business units in a country can produce in one year, the result show that GDP has a significant and positive influence on Indonesian shrimp exports to the US, with the probability value is 0.0382 in the short term and for the long term has value 0.0000. It is consistent with demand theory, where increasing income will increase demand for a product. The shrimp commodity is classified as a normal good, whereas everyday goods are goods whose demand will increase when income increases. Layna & Dewanta (2022) supported the study's results of the study Analyzing Factors Influencing on Indonesian Shrimp Exports to the US Market 1989-2018 which is has a positive and significant impact among US GDP and Indonesian shrimp exports to the United States (US).

Based on the results of data analysis, working capital loan interest rates does not have a significant impact on Indonesian shrimp exports with the probability value is 0.6726 in the short term while in the long term is 0.4598. Interest rates on working capital loans harm the volume of shrimp exports. The increase in interest rates will result in a decreasing number of exporters or producers borrowing funds. The study results supported by Wahyuni et al. (2013) on Factors Affecting the Volume of Cotton Exports in Bali Province 1994-2013 showed no significant influence between interest rates and the volume of cotton exports. It is because exporters and business people are less in utilizing funds from banks, where the source of capital for production activities does not only come from banks but can be obtained from the cost of capital of exporters themselves or looking for business relationships that have the same vision and mission as the business activities carried out so that a decrease or increase in working capital loan interest rates does not affect export activities.

The exchange rate is the price of one currency compared to another country's currency. Based on the results of data analysis in the short term and long term, it can be concluded that there is no significant influence among the price of export shrimp and Indonesian shrimp exports, where the probability value in the short time is 0.6701 and in the long term is 0.3582. Ulfa & Andriyani (2019) supported the study's results regarding the Analysis of Factors Affecting Non-Oil and Gas Commodity Exports in Indonesia 1985-2017 that there is no significant impact among exchange rates and exports. The insignificance of the exchange rate on exports could be due to the fact that Indonesia already has a large share of shrimp products in the world; Indonesia is one of the world's leading producers of shrimp commodities. Furthermore, when conducting import and export operations, the exporters and importers have agreed to consider the value of the currency used  as long as the transaction process (Yulianto et al., 2014).

The results showed that the probability value is 0.7095 in the short term  and for the long term amounted to 0.3585, so it can concluded that there is no significant effect between prices and Indonesian shrimp exports. The ups and downs of the prices does not have significant implications on the shrimp exports. The result align with Azizah & Setiawina's (2021) research with the tittle on the Analysis of the Impact of Production, Prices, and Exchange Rates on the

export of Cocoa Bean from Indonesia to the Netherlands that there is no significant effect between prices and cocoa bean exports.

## 6. Conclusion

Based on the results of the analysis, it can be concluded that shrimp production has a positive also significant impact on the shrimp exports from Indonesia to the United States (US) from 1989-2021 either in the short or long term, there is a difference between the results in the short term and long term, which is in the long term shows that United States (US) population has a significant impact with a negative side on the shrimp exports from Indonesia to the United States from 1989-2021 which is incosistent with the existing hypothesis, while in the short term show that population has a insignificant impact on Indonesian shrimp exports to the United States from 1989-2021, there is a positive and significant correlation either in short term or long term among US GDP and the volume of Indonesian shrimp exports to the United States (US) country from 1989-2021, while the interest rates on working capital loans either in the short term or long term does not have significant impact on the shrimp exports from Indonesia to the US from 1989-2021, the US exchange rate (rupiah) either in short term or long term does not have significant effect on the shrimp exports from Indonesia to the US from 1989-2021, the price of export shrimp does not have significant effect on the shrimp exports from Indonesia to the US from 1989-2021 either in the short time or long term.

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