IMPLEMENTATION OF SIMULTANEOUS APPROACH AS AN EFFORT TO INCREASE LOBSTER EXPORTS TO SUPPORT THE BLUE ECONOMY

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Abstract

Lobster is a high-value commodity in West Sumatra Province with great potential for export. However, the demand and supply of lobster exports are influenced by price fluctuations, Gross Domestic Product (GDP) growth, and currency exchange rates. This study aims to evaluate the effect of price, GDP, and exchange rates on lobster export volume using a simultaneous approach. The method used is quantitative descriptive with a simultaneous equation model that includes two equations, namely lobster export demand and supply. Data were collected from the Central Statistics Agency, the Ministry of Maritime Affairs and Fisheries, and other official sources for the period 2017-2023. The results of the study indicate that the increase in lobster prices reduces export demand, while GDP and exchange rates have a positive impact. The price increase also increases the supply of lobster, but high prices of substitute goods tend to reduce supply. The conclusion of this study highlights the importance of price policy, economic stability, and exchange rate regulation in the success of lobster exports from West Sumatra Province.

Keywords: *Simultaneous Approach; Export; Lobster; Price; GDP*

A. Introduction

The level of demand for lobster from neighboring countries is relatively high, due to the high demand for the international market, the tendency for lobster prices to continue to increase (Lastria et al., 2023; Radhakrishnan et al., 2019), this encourages fishermen in West Sumatra Province to continue to increase efforts to catch lobsters from nature as much as possible. In the last 2020-2023, it was suspected that there had been a decline in the lobster population which was marked by a decrease in the number of catches and the size of lobsters caught in nature, especially in the waters of West Sumatra (Ministry of Maritime Affairs and Fisheries, 2024). Meanwhile, the need for consumption-sized lobsters is mostly met from catches in nature. One of Indonesia's fishery commodities that has the potential to be developed is lobster (Panulirus spp) (Setyanto el al., 2019; Khoiriyah., 2023; Setyagama et al., 2023). Lobster has a high economic value and is intended for local and foreign consumption (export) marketing (Rahayu et al., 2023); Jaya et al (2023). The Indonesian government's export-import data notes that lobster is included in the Crustacea (shrimp) group which contributes a lot to the country's foreign exchange (Munthe et al., 2021). In Indonesia, West Sumatra Province is one of the lobster-producing waters that spread from the northwest to the southwest with a coastline that reaches around 375 kilometers. Identification of lobster species in West Sumatra waters generally found 6 types, namely: P. homarus, P. penicillatus, P. longipes, P. ornatus, P. versicolor and P. polyphagus (Pane et al., 2021; Lubis et al., 2023; Lubis et al., 2023; Lubis & Zakaria, 2021).

The lowest lobster production volume in Indonesia is still at 23,929.43 tons, but not all lobsters produced can be exported, most of the lobsters are also distributed to the local market or sold domestically. The decline in lobster production is inversely proportional to the demand for seawater lobsters in the international market which is high, reaching 2000–2500 tons/year (Ajdari & Mirzaei, 2022; Kyaw & Jalil, 2022). The high world demand for lobsters opens up opportunities for the Indonesian lobster export market. According to the UN Comtrade publication in 2019, Indonesia is the 17th largest lobster producing country in the world (Kyaw & Jalil, 2022; Butler et al., 2022; Briones-Fourzán et al., 2021). Based on data from the Indonesian statistics center in 2019, the largest lobster importing countries from Indonesia were China, Malaysia, Japan and Singapore (Wahyudin et al., 2017;

Lastria et al., 2023). The volume and value of Indonesian lobster exports experienced fluctuating growth as seen in Figure 2 which displays a graph of the volume and value of Indonesian lobster consumption exports in 2018-2023..

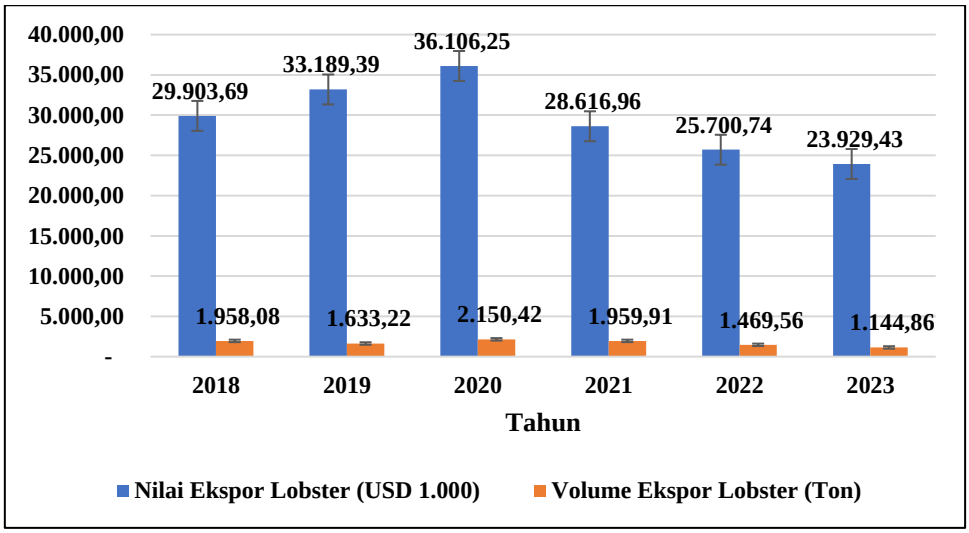

Figure 1. Volume and Value of Indonesian Lobster Exports 2018-2023
Source: Ministry of Marine Affairs and Fisheries, 2024

Based on Figure 1, the highest volume and value of Indonesian lobster consumption exports occurred in 2020 with a volume of 2,150.42 tons and a value of USD 36,106.25. The lowest export volume occurred in 2023 with a volume of 1,144.86 tons and the lowest export value occurred in 2023 of USD 23,929.43. The decline in lobster production, volume and export value contradicts several previous studies (Aisyah et al., 2022; Husni et al., 2023) which have stated that Japan's GDP per capita growth has a negative effect on tuna exports. The negative impact is associated with Japanese consumer preferences shifting from tuna to other seafood products that are considered more luxurious such as lobster and crab (Aisyah et al., 2022; Uzra et al., 2023).

This phenomenon is caused by changes in Japanese consumption patterns who tend to choose luxury products such as lobster and crab as part of a lifestyle that increases with increasing income compared to tuna (Aisyah et al., 2022; Husni et al., 2023). This previous study provides important insights into the dynamics of the international marine fish market (Uzra et al., 2023), especially in the context of changing consumer preferences related to the growth of the blue economy.

Research on the increase in demand and supply of lobster export volumes in West Sumatra Province has so far tended to focus on aspects of production, price dynamics, and macroeconomic analysis separately. Most studies have not integrated a simultaneous approach that considers the complex interactions between lobster prices, GDP growth, and exchange rate fluctuations. Using a simultaneous approach, this study aims to analyze the influence of these variables holistically, in order to provide more comprehensive insights in formulating an effective strategy to increase lobster export volume. The results are expected to support better policies and improve the welfare of fishermen in West Sumatra (Aisyah et al., 2022; Husni et al., 2023; Uzra et al., 2023).

Currently, research on factors influencing lobster export supply and demand has highlighted the role of variables such as price, GDP and exchange rate. However, most studies tend to treat these variables separately, without considering the complex interactions between them. Several previous studies have shown a relationship between lobster prices, DGP and exchange rate fluctuations with lobster exports. However, understanding how these variables simultaneously influence each other and their impact on lobster export supply and demand is still limited. Considering this background, there is currently an urgent need to conduct more in-depth research on efforts to increase lobster export volume. Through this study, macroeconomic factors such as lobster prices, GDP growth and currency exchange rates (exchange rates) have been identified as factors that may influence lobster export dynamics (Aisyah et al., 2022; Husni et al., 2023; Uzra et al., 2023; Rustam & Aisyah, 2022; Rustam & Aisyah,

2023). This study aims to analyze the relationship between lobster prices, GDP, and exchange rates on the supply and demand of lobster exports using a simultaneous approach.

B. Research methods

This study uses a quantitative descriptive approach, which aims to describe the values of a variable independently, be it one or more variables, without making comparisons or establishing relationships between variables (Syofya, 2022; Dani et al., 2025).

The data used in this study are secondary data published by the Indonesian Government, namely the Central Statistics Agency, Ministry of Fisheries and Maritime Affairs. The focus of the study is the demand and supply of lobster in West Sumatra province during the period January 2017 - December 2023. The endogenous variables are the demand and supply of lobster. While the exogenous variables include lobster prices, gross domestic product (GDP), and exchange rates. To clarify the understanding, measurement, and units of the variables in this study can be seen in Table 1 below.

Table 1. Operational Definition of Variables

Variables	Definisi Operasional	Satuan
Lobster Export Volume(Q_t^d)	Lobster Export Volume	Ton
Price (P_t)	Lobster Price	USD
Gross Domestic Product (GDP_t)	State Revenue	USD
Exchange Rate ($Kurs_t$)	USD/IDR Exchange Rate	USD/IDR

This study assumes that lobster export demand is influenced by price, GDP, and exchange rate. while lobster export supply is influenced by price, so that variables outside the model are considered not to have a significant effect. The Lobster Export Equation Model to obtain the equilibrium quantity is as follows:

$$Q_t = \Pi_4 + \Pi_5 GDP_t + \Pi_6 Kurs_t + \Pi_3 P_{t-1} + \nu_t \qquad (1)$$

Simultaneous analysis technique

a) Granger Causality Test

This study uses the Granger causality test. In seeing the relationship between endogenous variables in a research model, the Granger causality test can be used. If the test results show a probability value of less than = 0.05 (t-statistic is greater than t-table) then Ho is rejected or Ha is accepted (Syofya, 2022; Dani et al., 2020).

b) Identification Test Through Order Condition

The results of the Order Condition in this study are stated as follows:

Equality 1 : K-k = 3-2 = m-1 = 2-1 → 1 = 1 (identified)

Equality 2 : K-k = 3-1 > m-1 = 2-1 → 2 > 1 (overidentified)

From the results of the identification test using the second order conditions of the equation, it can be concluded that equations 1 and 2 are identified and overidentified. This means that the Two Stages Least Squared (TSLS) method is used to estimate the parameters of the existing equation.

c) Two Stages Least Squared (TSLS)

After the Granger Causality test and the Identification Test through Order Condition are fulfilled, the final stage carried out is to analyze the data using the Two Stages Least Squared (TSLS) method. The observed are:

- Using statistical tests to determine the statistical significance of the estimated model parameters, namely the t-test or F-test.
- Evaluating the model's suitability by examining the R-squared or Adjusted R-squared statistics.
- Interpreting the coefficients of the independent variables in the final regression to understand their influence on lobster export demand and supply.

C. Results And Discussion

The Granger Causality Test is conducted before estimating the endogenous variables. Table 2 shows the probability value of each variable from the Granger Causality Test results. This shows a two-way relationship, or reciprocal influence, between the lobster quantity (Q) and lobster price (Price) variables. The probability values are 0.0118 and 0.0411, respectively, lower than 0.05.

Table 2. Granger causality test results

Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
PRICE does not Granger Cause Q	81	3.91717	0.0118
Q does not Granger Cause PRICE		2.63444	0.0411

Source: Estimation results (processed)

The estimated results of the lobster export demand equation are shown in the following equation:

LOG(Q) = -14.08129 - 0.89363*LOG(PRICE) + 1.38093*LOG(GDP) + 0.77331*LOG(KURS) (2)

R2 = 0.851846

Probability F = 0.00000

Based on the estimation results of the Two-Stage Least Squares method, simultaneously the variables of price (PRICE), gross domestic product (GDP), and exchange rate (CURS) have a significant effect on the demand for lobster export quantity (Q), because they have a probability value of f-statistics (0.00000) less than 0.05. This function shows how the demand or quantity of lobster exports demanded is affected by changes in three main factors: price, economic growth, and exchange rate. By using the log-linear model, each coefficient in the equation can be interpreted as an elasticity, which measures the percentage change in export quantity in response to the percentage change in the related independent variable. The log-linear approach is very effective in analyzing price and income elasticity in the context of global fishery commodity exports, including lobster. The price log coefficient of -0.89363 indicates that when the price increases by 1%, the quantity of lobster exports demanded (Q) will decrease by 0.89363%.

The log GDP coefficient of 1.38093 indicates that a 1% increase in GDP will cause the quantity of lobster exports (Q) to increase by 1.38093%. This indicates a significant positive relationship between economic growth and demand for lobster exports. The log exchange rate coefficient of 0.77331 indicates that a 1% increase in the exchange rate will increase the quantity of lobster exports (Q) by 0.77331%. This means that when the domestic currency exchange rate weakens, domestic lobster products become cheaper for international consumers, so that demand for lobster exports increases.

The results of this estimation indicate that the quantity of lobster exports (Q) is negatively affected by price, but positively affected by economic growth (GDP) and the exchange rate (CURS). Thus, policies that affect these three variables, such as export price policy, macroeconomic policy, and exchange rate stability, will greatly determine the demand for lobster exports in the international market.

The results of the estimation of the lobster export supply equation are shown in the following equation:

LOG(Q) = 24.47469 + 29.73533*LOG(PRICE) - 31.84330*LOG(PRICE_T) (3)

R2 = 0.624031

Probability F = 0.000000

Based on equation 3 simultaneously the Export Price variable (PRICE), Substitute Goods Price (PRICE_T) has a significant effect on the supply of lobster export quantity (Q), this can be seen from the probability value of f-statistic (0.00000) which is smaller than 0.05. The constant value (intercept) of 24.47469 in the lobster export supply equation shows the basic potential of export quantity under certain conditions, when lobster price and substitute goods price are set at the base value. Although it cannot be interpreted directly in an economic context, this value gives an idea of the basic capacity of lobster supply. Export Price Coefficient (PRICE) The coefficient of 29.73533 for the log price (PRICE) shows that a 1% increase in lobster price will increase the quantity of lobster exports (Q) by 29.73533%.

This positive relationship reflects the incentive for producers to increase the quantity exported when prices increase, creating a strong relationship between price and supply. Coefficient of Substitute Goods Price (PRICE_T) The coefficient of -31.84330 for the log of the substitute good's price (PRICE_T) indicates that if the price of the substitute good increases by 1%, the quantity of lobster exports (Q) will decrease by 31.84330%. This negative relationship indicates that an increase in the price of a substitute good can encourage consumers to switch to other alternatives, thereby reducing the demand for lobsters. This supply equation shows that the quantity of lobster exports is very sensitive to price changes; an increase in the price of lobsters drives supply, while an increase in the price of alternative goods increases demand.

Discussion

A. Estimation of Demand Equation

This function shows how the demand or quantity of lobster exports demanded is affected by changes in three main factors: price, economic growth, and exchange rate. Using the log-linear model, each coefficient in the equation can be interpreted as an elasticity, which measures the percentage change in export quantity in response to a percentage change in the related independent variable. Research conducted by Li and Wang (2021) confirmed that the log-linear approach is very effective in analyzing price and income elasticity in the context of global fishery commodity exports, including lobster. The log price coefficient of -0.89363 indicates that when the price increases by 1%, the quantity of lobster exports (Q) demanded will decrease by 0.89363%.

The log price coefficient indicates that when the price increases by 1%, the quantity of lobster exports (Q) demanded will decrease by 0.89363%. This relationship is in accordance with basic economic theory regarding the law of demand, which states that when the price of a good increases, the quantity demanded tends to decrease, and vice versa. The magnitude of this coefficient indicates that price changes have a significant impact on the quantity of exports demanded. Research by Zhang et al. (2020) show that in the context of marine commodity markets, price elasticity remains significant, especially for products such as lobster, where price changes have a strong impact on the volume of export demand in major importing countries.

Price is one of the important factors in determining the demand for commodities, including lobster. An increase in the price of lobster will cause a decrease in demand, while a decrease in price will increase demand. According to research by Smith et al. (2020) that the price of lobster in the international market shows a negative relationship with demand, where every 10% increase in price causes a 5% decrease in demand. This shows that consumers tend to be more sensitive to the price of lobster as a luxury commodity

The log GDP coefficient shows that a 1% increase in GDP will cause the quantity of lobster exports (Q) to increase by 1.38093%. This shows a significant positive relationship between economic growth and demand for lobster exports. When the economy of the importing country grows, consumer purchasing power increases, so that demand for premium products such as lobster also increases. The magnitude of this coefficient shows that changes in the GDP of major importing countries have a strong effect on the quantity of lobster exports. This finding is in line with recent research by Liu et al. (2022), which found that an increase in GDP in developed countries significantly increases demand for premium fishery products such as lobster.

Economic growth in importing countries has a significant effect on the demand for lobster. As the economy grows, purchasing power increases, and demand for luxury goods such as lobsters increases. Jones (2018) states that a 1% GDP growth in an importing country can increase demand for lobsters by up to 2%. Thus, economic growth in lobster export destination countries such as the United States and China is often accompanied by an increase in demand for seafood products.

The log coefficient of the exchange rate shows that a 1% increase in the exchange rate will increase the quantity of lobster exports (Q) by 0.77331%. This means that when the domestic currency exchange rate weakens, domestic lobster products become cheaper for international consumers, so that the demand for lobster exports increases. This positive relationship reflects that currency exchange rate fluctuations can affect the competitiveness of lobster prices in the international market, which in turn affects the quantity of exports. A study by Chang and Lee (2021) shows that exchange rate volatility

during the COVID-19 pandemic has a significant impact on the demand for fishery product exports, with local currency depreciation increasing the competitiveness of products in the global market.

Currency exchange rate fluctuations greatly affect the prices of export commodities in the international market. When the exchange rate of the exporting country weakens, export products such as lobsters become cheaper for foreign buyers, which increases demand. A study by Wang and Lee (2019) shows that a 1% depreciation in the exchange rate can increase lobster exports by up to 3% in East Asian countries. This is due to more competitive prices, which benefits importing countries.

Overall, the estimation results show that the quantity of lobster exports (Q) is negatively affected by prices, but positively affected by economic growth (GDP) and exchange rates (CURS). Thus, policies that affect these three variables, such as export price policies, macroeconomic policies, and exchange rate stability, will greatly determine the demand for lobster exports in the international market. Recent research by Wang and Sun (2023) supports this conclusion by highlighting the importance of integrated macroeconomic policies, which focus not only on price stability but also economic growth and exchange rate management, especially in the context of export commodity markets such as lobsters that are highly dependent on global economic dynamics.

B. Estimation of Supply Equation

The Export Price Coefficient (PRICE) shows that a 1% increase in lobster prices will increase the quantity of lobster exports (Q) by 29.73533%. This positive relationship reflects the incentive for producers to increase the quantity exported when prices increase, creating a strong relationship between price and supply. This phenomenon is in accordance with classical supply theory, where an increase in the price of a commodity tends to increase the quantity supplied, as producers seek to maximize profits from the increase in price.

These results are in line with previous studies examining other export commodities. For example, research by Arsyad et al. (2020) which shows a similar relationship in tuna exports, where an increase in international prices has a positive effect on export quantity. They also found that the price elasticity of fishery commodities is quite high, indicating that fishery commodities such as lobster and tuna have similar characteristics in terms of responsiveness to price.

In addition, research conducted by Putra and Surya (2018) on shrimp exports shows that producers tend to take advantage of increases in international prices to increase exports, especially when global demand increases. This also shows that producers have the flexibility to adjust export quantities according to price changes. In terms of policy implications, these findings demonstrate the importance of maintaining price stability for export commodities such as lobster, both in domestic and international markets. Policies that support competitive prices can help producers maximize export potential. In addition, increasing prices can also trigger expansion of the fisheries sector to focus more on export markets, increasing foreign exchange.

Overall, these findings support previous literature and provide a deeper understanding of the dynamics of lobster export prices and quantities, with relevant implications for trade policy and fisheries sector development. Research by Fadli et al. (2023) shows that in the seafood market, higher prices not only encourage producers to increase production but also affect marketing and distribution strategies for products in the international market, leading to increased exports. In addition, research by Wang and Zhang (2021) states that increasing prices can also increase investment in production technology, which in turn contributes to increasing supply.

The Price Coefficient of Substitute Goods (PRICE_T) shows that if the price of substitute goods increases by 1%, the quantity of lobster exports (Q) will decrease by 31.84330%. This negative relationship indicates that an increase in the price of substitute goods can encourage consumers to switch to other alternatives, thereby reducing the demand for lobster. This reflects the competitive dynamics in the seafood market, where changes in the price of substitute goods can have a significant impact on the demand for lobster products. Research by Li and Zhang (2021) supports this finding by showing that demand for fishery products is highly influenced by the price of substitute goods, especially in markets with a wide range of product choices. In addition, research by Kumar and Patil (2022) found that changes in the price of substitute goods directly affect consumer purchasing decisions in the seafood category, including lobster. Overall, this supply equation shows that the quantity of lobster exports is

highly sensitive to price changes; an increase in the price of lobster drives supply, while an increase in the price of alternative goods increases demand. These results are very important for lobster export marketing policies and strategies, which need to consider price dynamics to maximize export potential. A study by Yu et al. (2023) emphasized that price management and understanding market behavior are essential to improving the competitiveness of export products, including lobster, in the international market. In addition, research by Johnson and Lee (2022) showed that a combination of pricing strategies and product innovation can help producers improve their competitiveness in the international market.

D. Conclusion

The conclusion of this study is that lobster prices, gross domestic product (GDP), and exchange rates have a significant effect on the demand and supply of lobster export volumes in West Sumatra Province. The study using a simultaneous approach showed that an increase in lobster prices had a negative effect on export demand, while economic growth (GDP) in importing countries and a weakening domestic exchange rate had a positive effect on demand. On the other hand, lobster export supply increased with an increase in lobster prices, while an increase in the price of substitute goods reduced lobster supply. These results indicate that policies related to prices, economic stability, and exchange rates are very important to increase lobster export volumes in the international market.

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