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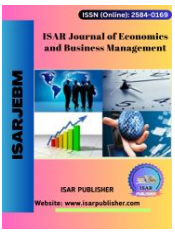

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ANALYSIS OF TUNA EXPORT SUPPLY RESPONSE IN INDONESIA

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Abstract: *This study aims to analyze the factors that influence the export supply of fresh, frozen, filled and canned tuna products in Indonesia. The form of the bid response is the Nerlove model and the estimation technique used is the Seemingly Unrelated Regression Equation using the Shazam application. This study used time series data for 96 months from January 2012 to December 2019. The results of estimates showed that the number of tuna exports the previous month, the international price of tuna, the international price of type-i tuna substitution commodities, and national prices had a real influence on tuna exports in Indonesia. The four types of tuna products are very responsive to the international price of tuna, the international price of commodity substitution and national prices. The elasticity of supply in the short and long term is inelastic.*

Keywords: *Supply, elasticity, export, tuna.*

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INTRODUCTION

Indonesia is one of the largest exporter of tuna in the world, this is due to the large potential of fisheries in Indonesia, especially in tuna commodities. Tuna is the second largest Indonesian fishery commodity exported after shrimp, in 2018 the export value reached US $ 747,416,812.00 million (BPS, 2020). Every year the amount of fishery consumption in the world has increased, in 2018 the amount of tuna consumption was 20,4 Kg per capita and increased to 20,5 kg per capita. The potential of Indonesian tuna is still very large and some areas that have the potential to produce tuna in Indonesia are the provinces of North Sumatra, Central Sulawesi, East Nusa Tenggara, West Sumatra and West Sulawesi can be used to increase state foreign exchange (KKP, 2018).

Indonesian tuna exports consist of 4 types of products including fresh, frozen, fillet and canned types. These four types of tuna are substituted for each other, when fresh type tuna is not there it will be replaced by frozen, fillet or canned tuna. The development of the four types of tuna export products, namely fresh, frozen, fillet and canned tuna every year, fluctuates where the type of fresh tuna products tends to decrease every year, but it is inversely proportional to the type of fillet tuna products more likely to increase. The same is also seen in types of frozen tuna products that tend to decrease while canned tuna is more likely to increase (UN Comtrade, 2020).

The price change in each type of tuna product is one of the factors that can cause fluctuations in the number of tuna exports. According to Hirschey and Pappas (1995) cited by Hidayati, et al (2007), the export price in most commodities is directly proportional to the quantity to be offered, or it can be said that when the price of the commodity rises then the quantity offered will also rise. Another factor that affects fisheries entrepreneurs in offering tuna abroad is national prices. According to Sitorus (2007), when the price of domestic tuna is higher than the international price, exporters will prefer to sell tuna in the country and vice versa. Based on this phenomenon will arise the question "what are the factors that affect the export supply of tuna in sharing the type of export products in Indonesia?"

There has been a lot of research on the export offering performance of various agricultural commodities in Indonesia, and the most is using the Nerlove equation, such as Kharoub & Ahmed (2022), Tupamahu (2017), Rahim (2016), Sukiyono (1995), Puluhulawa (2016). Estimates using the Nerlove model in the fisheries sector are also widely used as has been done by Le and Quang-Thanh (2020) on the response to the supply of black tiger shrimp in Vietnam, Bose and Redkar (2004) and Bose and Galvan (2005) in estimating import demand and export supply behavior of indian and New Zealand seafood products respectively, Naabi and Bose research (2020) on regulations affecting the export supply of seafood in Oman. Estimates made in the Nerlove equation are based on several phenomena, where the number of tuna exports in various types fluctuates. In addition, some of the variables that will be used in each equation tend to be the same, namely the price of the commodity itself and the price of the substitution commodity. These relationships or interrelationships will cause a high correlation between variables and equations. So for problems like this will be estimated together using the framework "Seemingly Unrelated Regression Equation". The purpose of this study was to analyze the factors that affect the number of tuna exports in fresh, frozen, fillet and canned products in Indonesia.

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RESERACH METHODS

Types and Sources of Data

The object studied was an analysis of the response of tuna export offers in Indonesia. The type of data used in this study is monthly secondary data (time series) period 2012:1-2019:12 (96 observations). The data sources used come from UN Comtrade, BPS, the Ministry of Marine Affairs and Fisheries, journals and other source data.

Econometric Model and Estimation Method

The methods in this study use descriptive and quantitative analysis. Descriptive analysis methods are used to explain and describe the export volume of fresh tuna, frozen tuna, fillet tuna and canned tuna in Indonesia. Quantitative analysis methods are used to determine the factors that affect the export supply of fresh tuna, frozen tuna, fillet tuna and canned tuna in Indonesia. There are 2 analyses used, namely the linear method with Maximum Likelihood and sure method (Seemingly Unrelated Regression Equations) with GLS (General Least Square) (Askari, 1977). The selection of the best estimation method will be done by looking at the value of chi-square, and comparing the number of signs and behaviors that match expectations. After getting the best estimation method, the next classic assumption test will be carried out in accordance with those carried out by Gujarati (2013) namely multicollinearity test, an autocorrelation test and a heteroskedasticity test.

In the specifications of the Indonesian tuna supply response model for both the type of fresh tuna products, canned tuna, frozen tuna or fillet tuna fish. It is assumed that Ei_t^D* as the number of fresh tuna exports that desired to export is a Pi_t^e as function of the expectation price of fresh tuna, PB_{t-1} as the price of frozen tuna the previous month, PP_{t-1} as the price of tuna fillet the previous month and PK_{t-1} as the price of canned tuna the previous month, EI_{t-1} as the number of exports of type i tuna fish the previous month, PN as the national price of tuna and NT as exchange rate rupiah against USD and time trend. In general, the tuna supply model in Indonesia can be expressed econometrically as follows:

$$Ei_t^D* = a_0 + a_1 Pi_t^e + a_2 PS_{t-1} + a_3 PB_{t-1} + a_4 PP_{t-1} + a_5 PK_{t-1} + a_6 PN + \alpha_7 NT \quad \text{.....1)}$$

In equation 1 there are variables that are not observed, namely Ei_t^D* and Pi_t^e. The number of fresh tuna that wants to be exported Ei_t^D* is the number of fresh tuna fish that want to be exported in the period t that follows the Partial Adjustment (PA) hypothesis. This hypothesis states that the actual change of the amount of fresh tuna fish to be exported is the proportion (h) of the desired acreage change coupled with the standard deviation. The PA hypothesis can be expressed as follows (Sukiyono, 1995):

$$Ei_t - Ei_{t-1} = h(Ei_t^D * - Ei_{t-1}) + u_t \quad \text{.....2)}$$

Where, E_t = actual number of tuna exports in month to t, Ei_t^(D*) = the number of tuna to be exported in the month to t, h= adjustment coefficient, 0<h≥1.

Using algebraic methods, equation 2 can be converted into:

$$Ei_t^D = \frac{1}{h}[E_t - (1-h)Ei_{t-1} - u_t] \quad \text{.....3)}$$

Then equation 3 is substituted in equation 1, then it is obtained:

$$Ei_t^D = a_0 h + (1-h)Ei_{t-1} + a_1 hPi_t^e + a_2 hPS_{t-1} + a_3 hPB_{t-1} + a_4 hPP_{t-1} + a_5 hPK_{t-1} + a_6 hPN + \alpha_7 hNT + u_t \quad \text{.....4)}$$

The price expectation of fresh tuna in the t period, where it is assumed to follow the "Adaptive Expectation hypothesis", is formulated as follows:

$$Pi_t^e - Pi_{t-1}^e = b(Pi_{t-1} - Pi_{t-1}^e), \quad 0<b\leq 1 \quad \text{.....5)}$$

Where, Pi_t^e= the price expectation of fresh tuna in the month t, - Pi_{t-1}^e= the actual price of fresh tuna in the month to t-1, and b = the coefficient of expectations. By following dhrymes (1981) cited by Sukiyono (1995), the price expectations of fresh tuna are specified as follows:

$$Pi_t^e = bZ_t = bf_0(1-b)^t \quad \text{.....6)}$$

By replacing Equation 6 into equation 4, the dynamic model of long-term supply for Indonesian tuna can be specified as follows:

$$Ei_t^D = a_0 h + (1-h)Ei_{t-1} + a_1 Z_t + f_0(1-b)^t + a_2 hPS_{t-1} + a_3 hPB_{t-1} + a_4 hPP_{t-1} + a_5 hPK_{t-1} + a_6 hPN + \alpha_7 hNT + u_t \quad \text{.....7)}$$

Where, $\alpha_0 = a_0 h$, $\alpha_1 = a_1 hb$, $\alpha_2 = a_2 h$, $\alpha_3 = a_3 h$, $\alpha_4 = a_4 h$, $\alpha_5 = a_5 h$, $\alpha_6 = a_6 h$, $\alpha_7 = a_7 h$

From the description of the long-term dynamic model for tuna in Indonesia, the empirical model for each type of export tuna is as follows:

a) Fresh tuna type export supply model

$$ES_t^D = a_0h + (1-h)ES_{t-1} + a_1ZS_t + f_0(1-b)^t + a_2hPB_{t-1} + a_3hPP_{t-1} + a_4hPK_{t-1} + a_5hPN + \alpha_6hNT + u_t$$

where ES_t^D is the number of fresh tuna fish that want to be exported in the month t.

b) Frozen tuna type export supply model

$$EB_t^D = a_0h + (1-h)EB_{t-1} + a_1ZB_t + f_0(1-b)^t + a_2hPS_{t-1} + a_3hPP_{t-1} + a_4hPK_{t-1} + a_5hPN + \alpha_6hNT + u_t$$

where EB_t^D is the number of frozen tuna that want to be exported in the month t.

c) Fillet tuna export export supply model

$$EP_t^D = a_0h + (1-h)EP_{t-1} + a_1ZP_t + f_0(1-b)^t + a_2hPS_{t-1} + a_3hPB_{t-1} + a_4hPK_{t-1} + a_5hPN + \alpha_6hNT + u_t$$

where EP_t^D is the number of fillet tuna that want to be exported in the month t.

d) Canned tuna export supply model

$$EK_t^D = a_0h + (1-h)EK_{t-1} + a_1ZK_t + f_0(1-b)^t + a_2hPS_{t-1} + a_3hPB_{t-1} + a_4hPP_{t-1} + a_5hPN + \alpha_6hNT + u_t$$

where EK_t^D is the number of canned tuna that want to be exported in the month t.

Once the empirical offering model of Indonesian tuna offering using the Partial Adjustment-Adaption Expectation model is formulated, the next step is to estimate this model. The estimation procedure in this study consists of two steps. Each model is estimated separately using Maximum Likelihood (ML). Furthermore, these four models, including frozen tuna, fillet tuna, fresh fish or canned tuna are estimated together using the "Seemingly Unrelated Regression Equation" framework.

The SURE (Seemingly Unrelated Regression Equation) method is used to simultaneously estimate 4 bidding models for four product types. To estimate regression parameters with the SURE framework, Estimated Generalised Least Square (EGLS), as Zellner suggested (1962), will be used to obtain this estimate, the first step is to estimate each equation with OLS. Then by using residual OLS (ut) estimator variants and covariance errors ($\alpha'_{i,j}S$) which are consistently obtained by:

$\alpha ij = \frac{1}{t} u'iuj \quad i,j = 1,2,3,4$ .....8)

Srivastava and Dwivedi (1979) say that the estimator is unbiased from $\sigma'_{ij}S$ can be sought by replacing 1/T with 1/(T-K) in equation 8 where K is the total number of regresors (free variables) that is clearly in one model. Furthermore, they say that the average estimator of the minimum square error (best invariant) of $\sigma'_{ij}S$ would be obtained if 1/(T-K+2) was substituted to 1/T in equation 8. Then the EGLS estimator for α parameters can be calculated with the following formulations:

$\alpha EGLS = (X'S\text{-}1X\text{-}1)X'S\text{-}1Y$ .....9)

where, α=vector of regression coefficient, X=matrix of independent, Y=vector all dependent variables S= $\sum \otimes IT$ $= \begin{pmatrix} \alpha 11 & \alpha 12 & \alpha 13 & \alpha 14 \\ \alpha 21 & \alpha 22 & \alpha 23 & \alpha 24 \\ \alpha 31 & \alpha 32 & \alpha 33 & \alpha 34 \\ \alpha 41 & \alpha 42 & \alpha 43 & \alpha 44 \end{pmatrix} \sum \otimes IT$ and IT is an indentity matrix.

Elasticity of Supply

In accordance with the formula mentioned by Koutsoyiannis (1977) cited by Suharno and Santoso (2008), in this study the supply response in the long term was carried out based on the response of the number of tuna export export offers on each type of export tuna product calculated by the following formula:

a) Short-term elasticity of supply

$$E_{SR} = \frac{\sigma A}{X_t} \times \frac{X_i}{A} = b\frac{\overline{X}}{\overline{Y}}$$

b) Long-term elasticity of supply

$$E_{LR} = \frac{E_{SR}}{1 - bQ_{t-1}}$$

Description: E_{SR}= Elasticity of short-term supply, E_{LR}= Long-term Supply Elasticity, b = regression coefficient of independent variabels type-i, $\overline{X}$= average of independent variabels type-i, $\overline{Y}$= average of dependent variabels.

RESULTS AND DISCUSSION

Determining the Best Estimation Model

Berdasarkan hasil estimasi menggunakan alat analisis Shazam Ver.10, maka diperolah hasil estimasi sebagai berikut:

Table 1. Estimation results in the four equations of response to Indonesian tuna export supply using the Maximum Likelihood Equation method and Seemingly Unrelated Regression Equation and Classic Assumption Test

Parameters	Estimated with Maximum Likelihood Equation				Estimated with Seemingly Unrelated Regression Equation			
	Fresh	Frozen	Fillet	Canned	Fresh	Frozen	Fillet	Canned
C	115,16	23,616	-29,603	15,026	47,853	9,538	-14,629	13,560
Eit-1	0,02854	0,29938	-0,3665	-0,17988	0,4832	0,0493	1,500	-0,1079
	(0,1027)	(0,0996)	(0,07734)	(0,08449)	(0,0922)	(0,1023)	(0,09812)	(0,08104)
Zi	-0.2977	-1,0209	-0,6898	-0,37741	0,007287	-0,1009	-2,897	-0,3490
	(0,1164)	(0,3132)	(0,0865)	(0,05721)	(0,004327)	(0,1604)	(0,0723)	(0,04759)
PSt-1	-	0,4847	-0,06547	-0,0139	-	0,3829	0,02169	0,009548
		(0,6416)	(0,2566)	(0,1404)		(0,6434)	(0,3619)	(0,1337)
PBt-1	-0,1747	-	-0,0716	-0,26981	-0,1760		-0,08377	-0,27548
	(0,1889)		(0,2570)	(0,1260)	(0,1731)		(0,2972)	(0,1143)
PPt-1	0,03923	-0,1006	-	-0,02965	0,01859	-0,1459		-0,05592
	(0,0586)	(0,1847)		(0,0412)	(0,6227)	(0,1893)		(0,04033)
PKt-1	0,02817	0,3114	-0,1960	-	-0,01627	1,2636	-1,960	
	(0,09757)	(0,1963)	(0,1350)		(0,07944)	(0,2307)	(0,1304)	
PN	-4,3079	1,3951	2,5664	0,1949	-3,1038	-0,0619	0,5702	0,2128
	(1,046)	(1,701)	(1,457)	(0,5488)	(0,7719)	(1,979)	(1,121)	(0,4460)
NT	-1,3624	-3,5418	0,5616	0,8291	0,7080	-0,4691	1,034	-0,7562
	(1,346)	(2,020)	(1,562)	0,5708	(0,7699)	(2,022)	(1,236)	(0,4668)
R2	0,8019	0,1832	0,6026	0,4782	0,7884	0,0796	0,3489	0,4601

Classsic Assumption Test

Tuna Export Types	Multicolinearity (value of correlation >0,8)	Autocorrelation (h value between -1,65 untul 1,65 in significant level 95%)	Heteroskedasticity (X^2 statistic <X^2 table (7,81))
Fresh	NT>0,8	-1,0233	5,948
Frozen	<0,8	-0,42933	3,616
Fillet	<0,8	0,91937	0,014
Canned	<0,8	1,4534	17,448

Source: Secondary Data, 2021 (processed)

Description: All variables are estimated in log form and numbers in parentheses are standard errors

The selection of the best method is done by looking at chi-square values and comparing the number of signs and behaviors that match expectations. Based on estimation results, variables that have signs and behaviors that match expectations more on estimates together with the SURE method. Furthermore, in the estimation results it is known that the chi-square value for the SURE method is at a confidence level of 95% meaning that the level of variable significance between equations in the system is closely related. In estimation using the SURE method also produces errors that are smaller than the estimate with the Maximum Likelihood method. This indicates that the use of the SURE method will result in a smaller error than the use of the Maximum Likelihood method if there is a correlation between errors in different equations (Alaba et.al, 2010). Based on these results, it can be known that the estimated response of tuna export supply in Indonesia will be better if estimated by the Seemingly Unrelated Equation (SURE) method. Then the next estimation results used are by the Seemingly Unrelated Regression Equation method.

Based on table 1, the results of the classical assumption test on the Seemingly Unrelated Regression Equation method show that in the fresh model there are symptoms of multicollinearity in the variable rupiah exchange rate against USD (NT). In accordance with the 2003 Gujarati cited by Juliansyah, et.al (2018) solutions to multicollinearity problems with the elimination of variables affected by symptoms of multicollinearity. In this study, researchers solved the multicolineartas problem by removing rupiah exchange rate variables. The removal of variable exchange rates is also supported by the findings of Widayanti et al (2019), the increasingly strengthened export exchange rate will lead to increasingly expensive export product prices for importer countries. When the export price of products gets more expensive, exports will also decrease, so there is a negative relationship between a country's exchange rate and its export volume. In models for frozen, fillet and canned-type tuna fish have no symptoms of multicollinearity, and for canned type tuna fish experience multicollinearity problems. Based on Whistler (2011), the value of h follows the normal distribution standard with the provision that the four h-calculated values are between -1,96 and 1,96. Thus, these four models are free from autocorrelation and reasoned enough to use this model to explain the influence of free variables on tuna supply response in Indonesia.

In the heteroskedasticity test, the regression equation of tuna supply response according to the type of export product, both fresh, frozen and fillet type is free from heteroskedasticity problems, because the X-statistic value is less than the X-table value at a significance level of 99 percent. But unlike the regression equation in canned types, it turns out to experience symptoms of heteroskedasticity. Then there needs to be improvements to eliminate the symptoms of heteroskedasticity from the model. The fix of heteroskedasticity problems in regression models for product types in cans is done using the ols het command in the Shazam ver 10 app.

Hypothesis Testing

The following estimates presented in Table 2 are the results of estimates that are free from the symptoms of mulitolinearity, autocorrelation and heteroskedastisity.

Table 2. Estimation results in the four equations of response to indonesian tuna export supply and Seemingly Unrelated Regression Equation

Parameters	Export Tuna Product Types			
	Fresh	Frozen	Fillet	Canned
C	43,273	1,9183	-43,757	19,168
Eit-1	0,5073*** (0,0959)	0,2384** (0,1045)	-0,2838 (0,0949)	-0,0460 (0,0826)
Zi	0,0085** (0,0041)	-0,1014 (0,1551)	-0,3137*** (0,0812)	-0,3281*** (0,0489)
PSt-1	-	0,6167 (0,6116)	-0,1735 (0,3159)	0,1463 (0,1293)
PBt-1	-0,2859* (0,1864)	-	-0,1559 (0,3076)	-0,2464** (0,1074)
PPt-1	0,0225 (0,0646)	-0,1654 (0,1953)	-	-0,0534 (0,0396)
PKt-1	0,0402 (0,0808)	0,2566 (0,2142)	-0,1444*** (0,1621)	-
PN	-2,4309*** (0,5625)	-0,1844 (0,8120)	3,3249*** (0,8729)	-0,3659* (0,1941)
R2	0,7896	0,0844	0,3963	0,4653

Source: Secondary Data, 2021 (processed)

Description: All variables are estimated in log form and numbers in parentheses are standard errors

* Significant in level 90%, ** Significant in level 95%, *** Significant in level 99%

Fresh Type Tuna Supply Model

Table 2, informs that the value of R^2 for the supply response equation in the fresh type is 78,96 percent. The value of the coefficient R^2 means that in the existing regression equation, the free variable is able to explain the non-free variable by 78,96 percent and the remaining 21,04 percent is a free variable that is not contained in this research model. Variables that have a marked effect on fresh tuna supply are the number of exports of fresh tuna in the previous month, international price expectations of fresh tuna and international prices of frozen tuna in the previous month.

Frozen Type Tuna Supply Model

Based Table 2, signs and behavior of free variable coefficients such as the number of exports of frozen tuna the previous month, the international price of fillet tuna and the national price of tuna have signs and behaviors that are in line with expectations. It is also known that the value of R^2 is 0,0844 which means that the free variable used in the model is able to explain the non-free variable by 8,44 percent. Another 91,66 percent was described by other variables that existed outside the free variables on the model.

Fillet Type Tuna Supply Model

The R^2 value is 0,3963 which means that the free variable used in the model is able to explain the non-free variable by 39,63 percent. Another 60,37 percent was explained by other variables that existed outside the free variables on the model. The independent variabels that corresponds to the expected signs and behavior is the international price variable of fresh, frozen and canned tuna in the previous month. Variables in the number of exports of fillet-type tuna in the previous month and international price expectations of tuna did not match the expected sign because it had a negative sign. Using partial testing methods, it was obtained that in this model, the international price variables of fresh, frozen and canned tuna and national prices had a statistical effect at a real level of 90 percent.

Canned Type Tuna Supply Model

Based on the Table 2 above, it can be seen the value of R2 of 0,4653 which means that the free variable contained in the model is able to explain the non-free variable by 46,53 percent. While the other 53,47 percent are free variables that are not contained in the model. There are three variables that correspond to the expected signs and behavior, namely the international price variable of frozen and fillet tuna in the previous month and the national price of tuna.

Elasticity of Supply

Similar to other agricultural products, the elasticity of tuna's supply is inelastic in the long term and short term. This is also shown in the Staniford (1988) where the offering of lobster fishing products has inelastic properties, and Andersen et.al (2008) salmon offerings also have inelastic properties.

Table 3. Estimated Short-term and Long-term Elasticity of The Number of Tuna Exports in Indonesia Based on The Type of Export Product

Type of Tuna Product	Price Elasticity of Tuna			
	Short-term	Description	Long-term	Description
Fresh	0,0085	Inelastic	0,017	Inelastic
Frozen	-0,1014	Inelastic	-0,133	Inelastic
Fillet	-0,649	Inelastic	-0,65	Inelastic
Canned	-0,328	Inelastic	-0,314	Inelastic

Source: Secondary Data, 2021 (Processed)

Table 3, informs that the elasticity of supply to its overall price for each type of tuna export product has inelastic properties. From the results of the estimated elasticity value of tuna price supply, it is known that the value of long-term elasticity is greater than the value of short-term elasticity. So that the opportunity or response to the current price of tuna, with the aim of increasing the number of exports in the long term is better than the opportunity in the short term. This is because in the long run fishermen or tuna fishing companies have the opportunity to make various adjustments in the amount of production and already have more independence to adopt the technology in the long term.

In two downstream products tuna, namely fillet and canned types both in the short and long term have inelastic elasticity, where usually downstream products are more elastic as mentioned by Daniel (2002) cited by Alfianto (2009). Some of the reasons it is possible that the nature of inelastis is the occurrence of a sharp decline in the number of tuna fleets and fishing vessels since 2015 and has not recovered until now (Ambari, 2021). This causes the amount of tuna supply to decrease so that in the event of a price increase in the market it will be quite difficult to meet due to lack of stock.

The inelastic nature of tuna products indicates the low response of Indonesian tuna exports to price changes in the market. Some things that can be done to increase tuna exports to better respond to price changes are for example for fresh tuna by increasing the supply of tuna stocks through increasing the fleet of tuna fishing boats and fishing boats. For processed products such as fresh, fillet and canned cans can be by diversifying the product, improving the quality of the product through resource improvement and improving the quality of tuna processing machine. With the improvement of tuna quality, Indonesia can open market opportunities in various other countries that have high tuna import conditions. These things can improve the response of tuna exports to price changes.

Discussion

The level of adjustment of the amount of exports and the length of time required for each type of tuna export product is presented in Table 2.

Table 2. Level of Adjustment of Export Amount and Length of Time Required

Type of Tuna Product	Adjustment Rate (%)	Length of Time Adjusting 95% (month)
Fresh	50	4,4
Frozen	78	2,1
Fillet	1,9	70,32
Canned	2,1	63,46

Source: Secondary Data, 2021 (Processed)

Table 2, showing where each type of tuna export product has a different level of adjustment. The highest adjustment rate is in fresh and frozen types of 50 and 78 percent in the period about 1,4 and 2,1 months. This is quite in accordance with the reality on the ground, because the quality of Indonesian tuna products for fresh and raw products is still quite low. In 2020 there were 97 cases of rejection of Indonesian fisheries exports. The most cases of rejection are tuna products with complaints of filthy, bacterial content or high histamine levels caused by poor handling of products (Asih, 2020).

Meanwhile, for fillet and canned type tuna have the longest export amount adjustment rate. Fillet and canned tuna is the most widely exported tuna processed product. In addition to Indonesia, Thailand is the world's top exporter and currently the Philippines also has the potential to export canned tuna. This will further strengthen the export competition of Indonesian canned tuna in foreign countries. Moreover, currently tuna importing countries are increasingly tightening tuna quality requirements (Kumparan Bisnis, 2019).

In general, exporters of tuna by product type are not very responsive to changes in the price of tuna itself and are not significant in real terms. The type of tuna product that is responsive to the price is fresh type tuna. This is in accordance with the findings of Rifaldi (2020) where the international price of tuna has a real effect on the number of tuna exports in Indonesia. This means that exporters of fresh tuna will be responsive to price changes in fresh type tuna commodities so that it will directly increase and reduce their offerings. Fresh tuna is one of the least exported tuna products with the main destination country being Japan and even Indonesia shows a very large dependence on imports from Japan (Wiranthi, 2020). In accordance with Wiranthi's research (2020) the decline and price increase in the Japanese market will be responded by Indonesia as an exporter.

Commodity substitution prices are an important factor that affects the number of tuna offerings in Indonesia. This conclusion is obtained from the results of tests on the price coefficient of commodity substitution as described earlier. The test results showed that tuna producers both fresh fillet and canned types behaved rationally in response to changes in commodity prices of type i tuna substitution. If commodity prices rise, producers will reduce the number of exports of tuna either fresh, frozen, fillet or canned types. Furthermore, economically the price of commodity substitution has a negative sign with the meaning that when the price of commodity substitution rises, the number of exports of tuna commodities will decrease (Heriyanto and Krisdina, 2011).

In terom of response to national price, fresh, frozen and canned tuna product types have a sign that is in accordance with expectations, tuna fish products are very responsive to changes in the national price of tuna. But in the equation of fillet tuna, the national price does not match the mark, meaning that although changes in national prices will not affect exporters in increasing or reducing the number of exports. Based on data from UN Comtrade (2020), fillet tuna products are the products with the second lowest number of exports after fresh. But exports of fillet tuna increased significantly in 2016, increasing by 68 percent. In addition, the international price of fillet tuna is the highest of the other 3 tuna products. These are some of the reasons that exporters are not very responsive to national prices.

CONCLUSION AND RECOMENDATION

The research found that factors that markedly influenced the increase of tuna exports were the amount of tuna exports the previous month, the international price expectations of fresh tuna and the international price of frozen tuna in the previous month. National prices have no real effect on the increase of exports of fresh tuna. Factors that affect the increase of frozen tuna exports in real terms are the previous tuna exports, the international price of fillet tuna and the national price of tuna. Meanwhile, factors that markedly influenced the increase of exports of fillet tuna include the international price of fresh, frozen and canned tuna in the previous month, and the national price of tuna. In addition, the research also found that factors that affect the increase of exports of canned tuna in real terms are the international price of frozen and fillet tuna in the previous month and the national price of tuna.

One of the variables used in the estimation is the rupiah exchange rate variable against US dollar experiencing symptoms of multicollinearity, one of the causes is a short time span data. It is expected that further research can be conducted using exchange rate variables with a longer time span to find out its effect on tuna fish offerings in Indonesia. In addition, based on the results of the research obtained, the level of adjustment in the number of exports of fresh and frozen tuna is the highest with the shortest adjustment period. It is expected that the government can improve the quality of fresh and frozen tuna production to match the quality standards of export destination countries such as Japan for fresh types and the European Union for frozen types.

The type of tuna export product that is most responsive to price changes is the fresh type with the main export destination country being Japan. It is expected that the government through the Indonesian Ministry of Marine Affairs and Fisheries in coordination with the Indonesian Ministry of Trade to be able to establish cooperation with other countries to export fresh type tuna. This is because when the price of tuna in Japan is low, the government can export to other countries. In addition, this is done to reduce the dependence of fresh tuna exports to Japan.

Tuna exports are also responsive to national tuna prices. It is expected that the government can further maintain the stability of tuna prices in Indonesia. Government policies in supporting the international trade in tuna need to be balanced with policies in increasing the amount of production. This is done so that the increase in the supply of the number of exports to countries in the international market can be fulfilled without increasing the price of domestic tuna, due to the scarcity of tuna in the domestic market.

Fillet and canned tuna as processed products have inelastic properties. The policy of the government to increase tuna fishing areas by increasing the fleet and number of tuna fishing vessels to increase the supply of tuna fish, so that processed tuna products can more quickly respond to price changes that occur. In addition, there is a suspicion that tuna export data will be better if analyzed from the demand side. It is expected that there will be further research that analyzes tuna exports from two sides, namely demand and supply with a simultaneous approach.

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